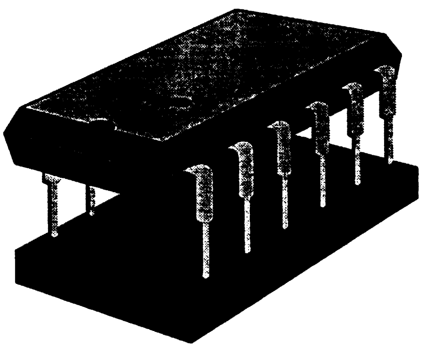
ORION ATLANTIC EUROPE, Inc.

VSAT Certification Training Course



Ground Operator Equipment Reference Manual

ORION ATLANTIC EUROPE, Inc.

Grounds Operator Equipment Manual

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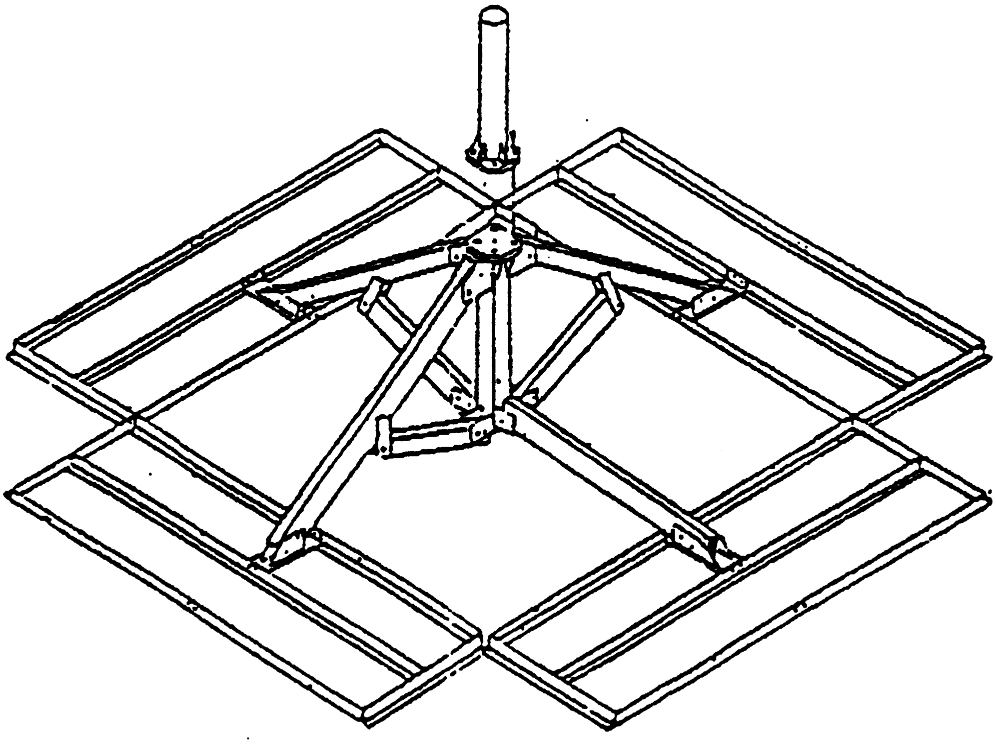
ORION ATLANTIC EUROPE

MODEL VL-10

ASSEMBLY INSTRUCTIONS



BAIRD
SATELLITE
SUPPORTING SYSTEMS
P.O. BOX 2366 (ZIP 50704)
3160 LOGAN AVENUE
WATERLOO, IOWA, USA 50703
PHONE: (319) 233-3561 FAX: (319) 235-7653

MODEL VL-10

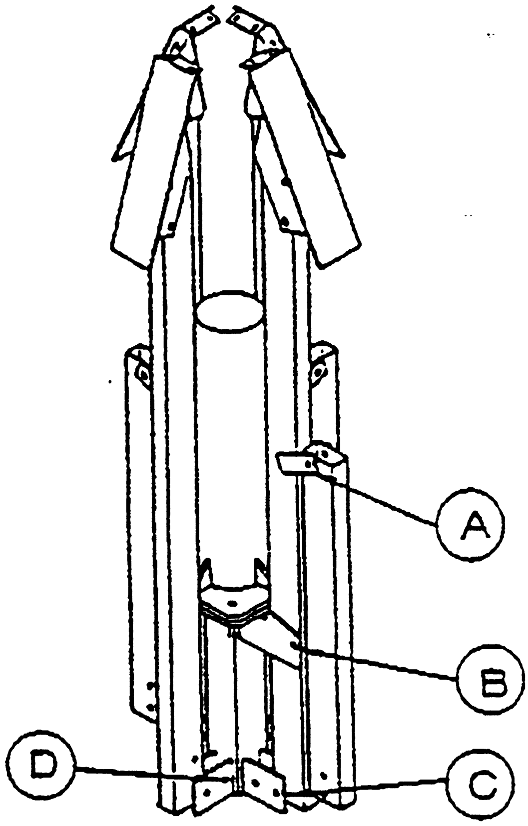


FIGURE 1

THE VL-10 MOUNTING SYSTEM IS SHIPPED ASSEMBLED AS SHOWN IN FIG. 1

ASSEMBLY

1.) LOOSEN HARDWARE AT POSITION "A" ON EACH LEG.

2.) REMOVE HARDWARE FROM POSITIONS "B" & "C". REMOVE THE LEG ASSEMBLY FROM THE BASE ASSEMBLY. REPEAT PROCESS FOR EACH LEG ASSEMBLY. REMOVE HARDWARE FROM POSITIONS "C" & "D" ON THE 4TH LEG. SAVE THE HARDWARE AS IT WILL BE REUSED.

3.) REMOVE THE HARDWARE BAG LOCATED INSIDE THE O.D. PIPE.

4.) PLACE A 3"-4" BLOCK UNDER THE BASE ASSEMBLY.(NOT NECESSARY BUT IT WILL EASE THE INSTALLATION OF THE ARM ASSEMBLIES)

5.) THEN, PLACE THE LONG TUBE OF THE LEG ASSEMBLY INTO THE UPPER FINS AND LOOSELY SECURE USING BOLT,NUT & LOCKWASHER. NEXT, PLACE THE BRACE TUBE INTO THE LOWER FINS AND SECURE LOOSELY. REPEAT THIS PROCEDURE FOR THREE LEG ASSEMBLIES.

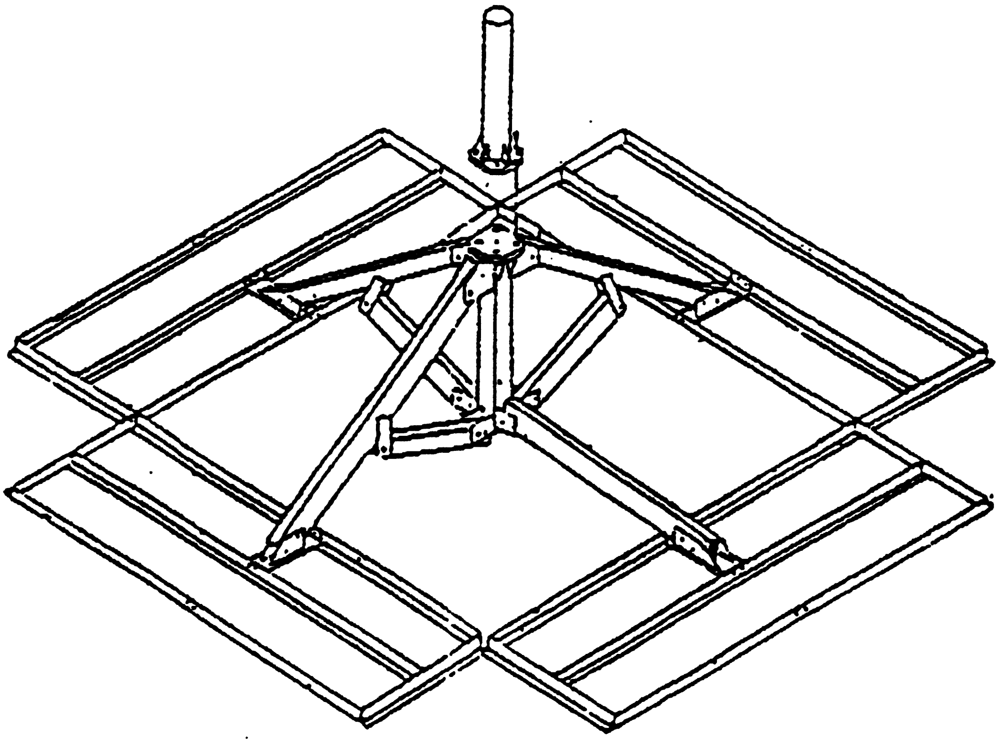
6.) PLACE THE END OF THE 4TH LEG ASSEMBLY INTO THE LOWER FIN AND SECURE USING BOLT, NUT AND LOCKWASHER.

7.) *TIGHTEN ALL HARDWARE*

ORION ATLANTIC EUROPE

MODEL VL-10

ASSEMBLY INSTRUCTIONS



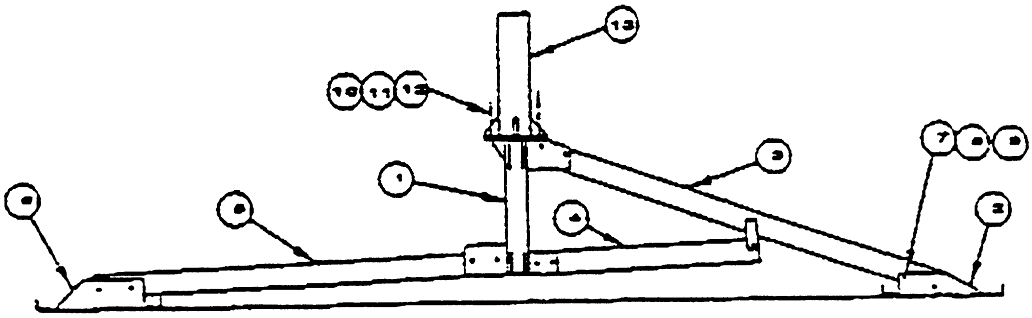
BAIRD
SATELLITE
SUPPORTING SYSTEMS
P.O. BOX 2368 (ZIP 50704)
3160 LOGAN AVENUE
WATERLOO, IOWA, USA 50703
PHONE: (319) 233-3561 FAX: (319) 235-7653

MODEL VL-10

VL-10

MATERIAL CHECKLIST

PART #	QTY.	DESCRIPTION
1	1	BASE ASSEMBLY
2	4	SHOE
3	4	ARM ASSEMBLY 56"LONG
4	4	BRACE 30.5" LONG
5	1	4TH LEG 55" LONG
6	1	4TH FOOT
7	25	1/2" X 2-3/4 BOLT
8	25	1/2" NUT
9	25	1/2" LOCKWASHER
10	4	5/8" X 2.00 BOLT
11	4	5/8" NUT
12	4	5/8" LOCKWASHER
13	1	O.D. PIPE



ASSEMBLY

1.) THE FOLLOWING INSTRUCTIONS WILL BE HELPFUL IF THE UNIT WAS NOT RECEIVED PACKAGED AS IN THE PREVIOUS INSTRUCTIONS.

2.) CHECK TO SEE THAT THERE ARE NO MISSING PARTS.

3.) LOCATE A 56" ARM, WITH THE TABS POINTING DOWNWARD AND AWAY FROM THE BASE. ATTACH THE ARM TO THE UPPER FINS ON THE BASE USING TWO 1/2" X 2-3/4 BOLTS,NUTS & LOCKWASHERS. (NOTE: LEAVE ALL HARDWARE LOOSE UNTIL ASSEMBLY IS COMPLETED.)

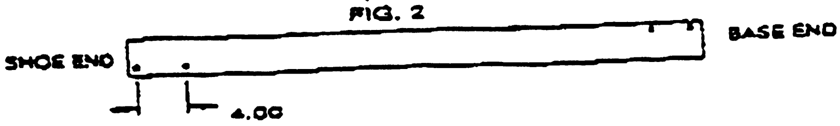
4.) ATTACH THE 30.5" BRACE TO THE LOWER FINS ON THE BASE USING TWO 1/2 X 2-3/4" BOLTS, NUTS & LOCKWASHERS. ATTACH THE OTHER END OF THE BRACE TO THE TABS LOCATED ON THE 56" ARM, USING ONE 1/2 X 2-3/4" BOLT, NUT & LOCKWASHER. (NOTE THE SINGLE HOLE ON THE BRACE SHOULD BE TOWARDS THE TOP OF THE PIECE.)

5.) ATTACH A SHOE TO THE END OF THE 56" ARM, USING TWO 1/2 X 2-3/4 BOLTS, NUTS & LOCKWASHERS.

6.) REPEAT THIS PROCEDURE FOR THREE LEGS OF THE BASE.

7.) ATTACH ONE END OF THE 4TH LEG TO THE BASE & THE OTHER END TO THE 4TH SHOE *see fig. 2 below* USING FOUR 1/2 X2-3/4 BOLTS, NUTS & LOCKWASHERS.

FIG. 2



8.) ATTACH O.D. PIPE AND *TIGHTEN ALL HARDWARE*

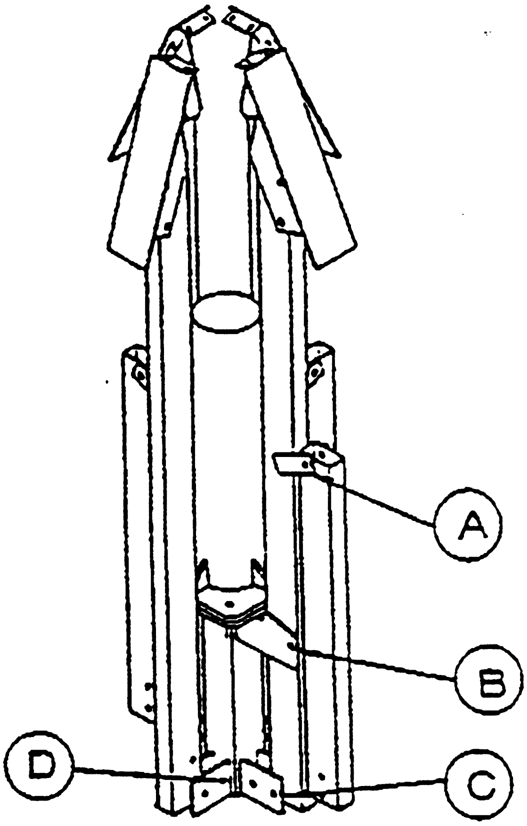


FIGURE 1

THE VL-10 MOUNTING SYSTEM IS SHIPPED ASSEMBLED AS SHOWN IN FIG. 1

ASSEMBLY

1.) LOOSEN HARDWARE AT POSITION "A" ON EACH LEG.

2.) REMOVE HARDWARE FROM POSITIONS "B" & "C". REMOVE THE LEG ASSEMBLY FROM THE BASE ASSEMBLY. REPEAT PROCESS FOR EACH LEG ASSEMBLY. REMOVE HARDWARE FROM POSITIONS "C" & "D" ON THE 4TH LEG. SAVE THE HARDWARE AS IT WILL BE REUSED.

3.) REMOVE THE HARDWARE BAG LOCATED INSIDE THE O.D. PIPE.

4.) PLACE A 3"-4" BLOCK UNDER THE BASE ASSEMBLY.(NOT NECESSARY BUT IT WILL EASE THE INSTALLATION OF THE ARM ASSEMBLIES)

5.) THEN, PLACE THE LONG TUBE OF THE LEG ASSEMBLY INTO THE UPPER FINS AND LOOSELY SECURE USING BOLT,NUT & LOCKWASHER. NEXT, PLACE THE BRACE TUBE INTO THE LOWER FINS AND SECURE LOOSELY. REPEAT THIS PROCEDURE FOR THREE LEG ASSEMBLIES.

6.) PLACE THE END OF THE 4TH LEG ASSEMBLY INTO THE LOWER FIN AND SECURE USING BOLT, NUT AND LOCKWASHER.

7.) *TIGHTEN ALL HARDWARE*

BALLAST TRAY OPTIONS

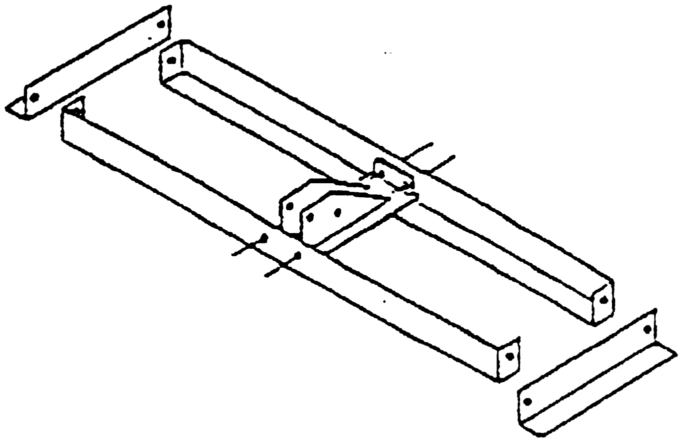
1'4" X 8'

ONE BAG OF:

32 - 3/8" X 1" BOLT
32 - 3/8" NUT
32 - 3/8" LOCKWASHER

ONE BUNDLE CONTAINS:

8 - 96" ANGLE
8 - 16" ANGLE



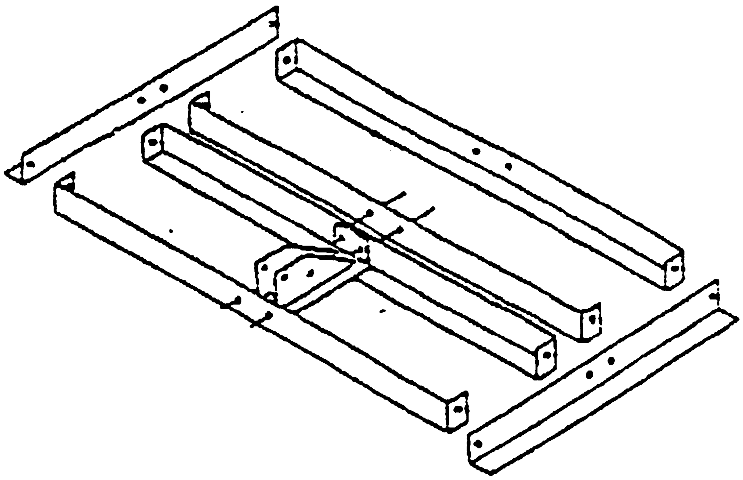
2'8" X 8'

2 BAGS
EACH CONTAINS:

24 - 3/8" X 1" BOLT
24 - 3/8" NUT
24 - 3/8" LOCKWASHER

2 BUNDLES
EACH CONTAINS:

8 - 96" ANGLE
4 - 32" ANGLE



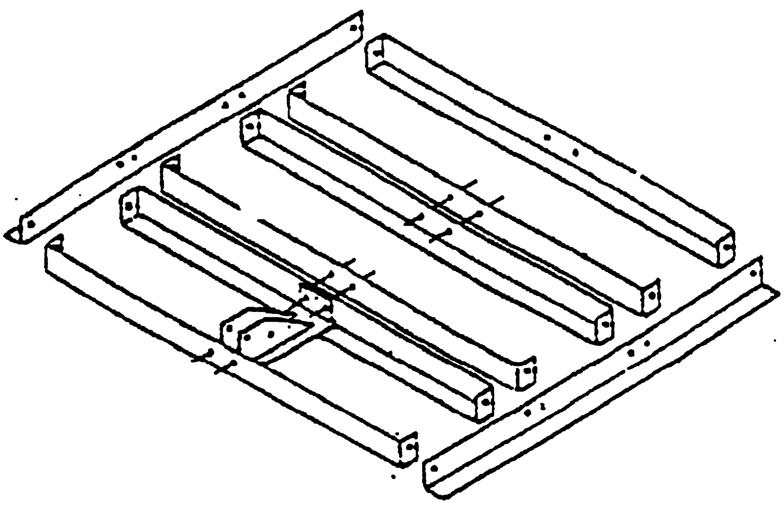
4' X 8'

2 BAGS
EACH CONTAINS:

36 - 3/8" X 1" BOLT
36 - 3/8" NUT
36 - 3/8" LOCKWASHER

2 BUNDLES
EACH CONTAINS:

12 - 96" ANGLE
4 - 48" ANGLE



BAIRD SATELLITE SUPPORTING SYSTEMS

BALLAST CALCULATION REPORT

MODEL PL-10/VL-10

Model PL-10 / VL-10

for a

6'(1.8m) Antenna

8'(2.4m) Antenna

and

10'(3.0m) Antenna

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BAIRD SATELLITE SUPPORTING SYSTEMS

PL-10/VL-10

6'(1.8M) ANTENNA

CODE: ANSI/ASCE 7-88

I. Building Height 0'-20' (total weight of antenna, mount and ballast)

		Wind Speed						
		70 MPH	80 MPH	90 MPH	100 MPH	110 MPH	120 MPH	125 MPH
Tethered on any type roof ;' base height	exp."B"	333	435	551	680	823	980	1063
	exp."C"	564	737	932	1151	1393	1657	1798
Untethered Built-up roof cu = .75	exp."B"	456	596	754	931	1127	1341	1455
	exp."C"	772	1008	1276	1576	1907	2269	2462
Untethered Rubber membrane roof cu = .70	exp."B"	489	639	808	998	1207	1437	1559
	exp."C"	827	1080	1367	1688	2043	2431	2638
Untethered Concrete roof cu = .58	exp."B"	647	844	1069	1319	1596	1900	2062
	exp."C"	1094	1429	1808	2233	2701	3215	3488

-To achieve a static friction coefficient of 0.75 on a built-up roof(tar & gravel), a 1/8" thick rubbor matting must be placed between the ballast trays and the roof. Any loose gravel should be removed from the area under the rubber matting.
-To achieve a static friction coefficient of 0.70 on a rubber membrane roof, a 1/8" thick rubber matting must be placed between the ballast trays and the roof. The rubber matting will also serve to protect the membrane roof.
-The 0.58 static friction coefficient on the concrete roof is based on the ballast trays sitting directly on the concrete surface.

To obtain the required ballast weight(concrete blocks) subtract the weight of the base, mast, ballast trays and antenna from the weight given in the table. This gives the total weight of concrete block required to be placed on the ballast trays. The total weight of concrete blocks should be divided equally among the four ballast trays.

UNIT WEIGHTS

PL-10 Base.................................162 lbs.
VL-10 Base.................................167 lbs
1'4" x 8" Ballast Tray..................119 lbs
*2'8" x 8' Ballast Tray.................238 lbs
**4' x 8' Ballast Tray...................356 lbs
***5'4" x 8' Ballast Tray...........540 lbs
Mast Weight given on Page 8 of Section 1

BAIRD SATELLITE SUPPORTING SYSTEMS

PL-10/VL-10

6'(1.8M) ANTENNA

CODE: ANSI/ASCE 7-88

I. Building Height 20'-40' (total weight of antenna, mount and ballast)

		Wind Speed						
		70 MPH	80 MPH	90 MPH	100 MPH	110 MPH	120 MPH	125 MPH
Tethered on any type roof base height	exp."B"	415	542	687	848	1026	1220	1324
	exp."C"	655	856	1083	1337	1618	1926	2090
Untethered Built-up roof cu = .75	exp."B"	569	743	940	1160	1404	1671	1813
	exp."C"	897	1172	1483	1831	2215	2636	2861
Untethered Rubber membrane roof cu = .70	exp."B"	609	796	1007	1243	1504	1790	1942
	exp."C"	961	1255	1589	1961	2373	2825	3065
Untethered Concrete roof cu = .58	exp."B"	806	1052	1332	1644	1989	2367	2569
	exp."C"	1271	1660	2101	2594	3139	3735	4053

-To achieve a static friction coefficient of 0.75 on a built-up roof(tar & gravel), a 1/8" thick rubber matting must be placed between the ballast trays and the roof. Any loose gravel should be removed from the area under the rubber matting.
-To achieve a static friction coefficient of 0.70 on a rubber membrane roof, a 1/8" thick rubber matting must be placed between the ballast trays and the roof. The rubber matting will also serve to protect the membrane roof.
-The 0.58 static friction coefficient on the concrete roof is based on the ballast trays sitting directly on the concrete surface.

To obtain the required ballast weight(concrete blocks) subtract the weight of the base, mast, ballast trays and antenna from the weight given in the table. This gives the total weight of concrete block required to be placed on the ballast trays. The total weight of concrete blocks should be divided equally among the four ballast trays.

UNIT WEIGHTS

PL-10 Base	162 lbs.
VL-10 Base	167 lbs
1'4" x 8" Ballast Tray	119 lbs
*2'8" x 8' Ballast Tray	238 lbs
**4' x 8' Ballast Tray	356 lbs
***5'4" x 8' Ballast Tray	540 lbs
Mast Weight given on Page 8 of Section 1	

BAIRD SATELLITE SUPPORTING SYSTEMS

PL-10/VL-10

8'(2.4M) ANTENNA

CODE: ANSI/ASCE 7-88

I. Building Height 0'-20' (total weight of antenna, mount and ballast)

		Wind Speed						
		70 MPH	80 MPH	90 MPH	100 MPH	110 MPH	120 MPH	125 MPH
Tethered on any type roof base height	exp."B"	556	726	918	1134	1372	1633	1771
	exp."C"	940	1228	1554	1918	*1871	*2226	*2416
Untethered Built-up roof cu = .75	exp."B"	811	1060	1341	1655	2003	2384	2587
	exp."C"	1373	1793	2269	2801	3389	4034	4377
Untethered Rubber membrane roof cu = .70	exp."B"	869	1135	1437	1774	2146	2554	2771
	exp."C"	1471	1921	2431	3001	3632	4322	4689
Untethered Concrete roof cu = .58	exp."B"	1078	1407	1781	2199	2661	3167	3436
	exp."C"	1823	2381	3014	3721	4502	5358	5814

-To achieve a static friction coefficient of 0.75 on a built-up roof(tar & gravel), a 1/8" thick rubber matting must be placed between the ballast trays and the roof. Any loose gravel should be removed from the area under the rubber matting.

-To achieve a static friction coefficient of 0.70 on a rubber membrane roof, a 1/8" thick rubber matting must be placed between the ballast trays and the roof. The rubber matting will also serve to protect the membrane roof.

-The 0.58 static friction coefficient on the concrete roof is based on the ballast trays sitting directly on the concrete surface.

To obtain the required ballast weight(concrete blocks) subtract the weight of the base, mast, ballast trays and antenna from the weight given in the table. This gives the total weight of concrete block required to be placed on the ballast trays. The total weight of concrete blocks should be divided equally among the four ballast trays.

UNIT WEIGHTS

PL-10 Base	162 lbs.
VL-10 Base	167 lbs
1'4" x 8" Ballast Tray	119 lbs
*2'8" x 8' Ballast Tray	238 lbs
**4' x 8' Ballast Tray	356 lbs
***5'4" x 8' Ballast Tray	540 lbs
Mast Weight given on Page 8 of Section 1	

BAIRD SATELLITE SUPPORTING SYSTEMS

PL-10/VL-10

8'(2.4M) ANTENNA

CODE: ANSI/ASCE 7-88

I. Building Height 20'-40' (total weight of antenna, mount and ballast)

		Wind Speed						
		70 MPH	80 MPH	90 MPH	100 MPH	110 MPH	120 MPH	125 MPH
Tethered on 'y type roof base height	exp."B"	692	904	1144	1413	1709	2034	2207
	exp."C"	1092	1426	1805	2229	*2174	*2587	*2807
Untethered Built-up roof cu = .75	exp."B"	1011	1320	1671	2063	2496	2970	3223
	exp."C"	1595	2083	2636	3255	3938	4687	5085
Untethered Rubber membrane roof cu = .70	exp."B"	1083	1414	1790	2210	2674	3183	3453
	exp."C"	1709	2232	2825	3487	4219	5021	5449
Untethered Concrete roof cu = .58	exp."B"	1343	1754	2219	2740	3315	3946	4281
	exp."C"	2118	2767	3502	4323	5231	6225	6755

-To achieve a static friction coefficient of 0.75 on a built-up roof(tar & gravel), a 1/8" thick rubber matting must be placed between the ballast trays and the roof. Any loose gravel should be removed from the area under the rubber matting.
-To achieve a static friction coefficient of 0.70 on a rubber membrane roof, a 1/8" thick rubber matting must be placed between the ballast trays and the roof. The rubber matting will also serve to protect the membrane roof.
-The 0.58 static friction coefficient on the concrete roof is based on the ballast trays sitting directly on the concrete surface.

To obtain the required ballast weight(concrete blocks) subtract the weight of the base, mast, ballast trays and antenna from the weight given in the table. This gives the total weight of concrete block required to be placed on the ballast trays. The total weight of concrete blocks should be divided equally among the four ballast trays.

UNIT WEIGHTS

PL-10 Base	162 lbs.
VL-10 Base	167 lbs
1'4" x 8" Ballast Tray	119 lbs
*2'8" x 8' Ballast Tray	238 lbs
**4' x 8' Ballast Tray	356 lbs
***5'4" x 8' Ballast Tray	540 lbs
Mast Weight given on Page 8 of Section 1	

BAIRD SATELLITE SUPPORTING SYSTEMS

PL-10/VL-10

10'(3.0M) ANTENNA

CODE: ANSI/ASCE 7-88

I. Building Height 0'-20' (total weight of antenna, mount and ballast)

		Wind Speed						
		70 MPH	80 MPH	90 MPH	100 MPH	110 MPH	120 MPH	125 MPH
Tethered on any type roof base height	exp."B"	1111	1451	1837	2267	*2211	*2632	*2855
	exp."C"	1880	*1979	*2505	*3092	**3134	**3729	**4046
Untethered Built-up roof cu = .75	exp."B"	1267	1655	2095	2587	3130	3725	4042
	exp."C"	2145	2801	3545	4377	5296	6303	6839
Untethered Rubber membrane roof cu = .70	exp."B"	1358	1774	2245	2771	3353	3991	4330
	exp."C"	2298	3001	3798	4689	5674	6753	7327
Untethered Concrete roof cu = .58	exp."B"	1724	2252	2850	3518	4257	5066	5497
	exp."C"	2917	3810	4822	5953	7204	8573	9302

-To achieve a static friction coefficient of 0.75 on a built-up roof(tar & gravel), a 1/8" thick rubber matting must be placed between the ballast trays and the roof. Any loose gravel should be removed from the area under the rubber matting.
-To achieve a static friction coefficient of 0.70 on a rubber membrane roof, a 1/8" thick rubber matting must be placed between the ballast trays and the roof. The rubber matting will also serve to protect the membrane roof.
-The 0.58 static friction coefficient on the concrete roof is based on the ballast trays sitting directly on the concrete surface.

To obtain the required ballast weight(concrete blocks) subtract the weight of the base, mast, ballast trays and antenna from the weight given in the table. This gives the total weight of concrete block required to be placed on the ballast trays. The total weight of concrete blocks should be divided equally among the four ballast trays.

UNIT WEIGHTS

PL-10 Base	162 lbs.
VL-10 Base	167 lbs
1'4" x 8" Ballast Tray	119 lbs
*2'8" x 8' Ballast Tray	238 lbs
**4' x 8' Ballast Tray	356 lbs
***5'4" x 8' Ballast Tray	540 lbs
Mast Weight given on Page 8 of Section 1	

PL-10/VL-10

10'(3.0M) ANTENNA

CODE: ANSI/ASCE 7-88

I. Building Height 20'-40' (total weight of antenna, mount and ballast)

		Wind Speed						
		70 MPH	80 MPH	90 MPH	100 MPH	110 MPH	120 MPH	125 MPH
Tethered on any type roof base height	exp."B"	1384	1808	2288	*2277	*2755	*3279	*3558
	exp."C"	2184	*2299	*2910	**3009	**3641	**4333	**4701
Untethered Built-up roof cu = .75	exp."B"	1579	2063	2611	3223	3900	4641	5036
	exp."C"	2492	3255	4119	5085	6153	7323	7946
Untethered Rubber membrane roof cu = .70	exp."B"	1692	2210	2797	3453	4178	4973	5396
	exp."C"	2670	3487	4413	5449	6593	7846	8513
Untethered Concrete roof cu = .58	exp."B"	2148	2806	3551	4384	5305	6313	6850
	exp."C"	3389	4427	5603	6917	8370	9961	10808

-To achieve a static friction coefficient of 0.75 on a built-up roof(tar & gravel), a 1/8" thick rubber matting must be placed between the ballast trays and the roof. Any loose gravel should be removed from the area under the rubber matting.
-To achieve a static friction coefficient of 0.70 on a rubber membrane roof, a 1/8" thick rubber matting must be placed between the ballast trays and the roof. The rubber matting will also serve to protect the membrane roof.
-The 0.58 static friction coefficient on the concrete roof is based on the ballast trays sitting directly on the concrete surface.

To obtain the required ballast weight(concrete blocks) subtract the weight of the base, mast, ballast trays and antenna from the weight given in the table. This gives the total weight of concrete block required to be placed on the ballast trays. The total weight of concrete blocks should be divided equally among the four ballast trays.

UNIT WEIGHTS

PL-10 Base	162 lbs.
VL-10 Base	167 lbs
1'4" x 8' Ballast Tray	119 lbs
*2'8" x 8' Ballast Tray	238 lbs
**4' x 8' Ballast Tray	356 lbs
***5'4" x 8' Ballast Tray	540 lbs

Mast Weight given on Page 8 of Section 1

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2.4 METER (NPMM) NON-PENETRATING MAST MOUNT

ASSEMBLY MANUAL

SECTION I

1.0 GENERAL INFORMATION

1. Prior to installation, verify that the installation site roof material and supporting structure have been investigated and found capable of withstanding all loads imposed by the proposed antenna system. Confirm that the supporting surfaces, anchors, and/or safety cables, if required, have been found to be adequate to resist the reactions from the antenna system and that the installation will be in accordance with all applicable local, state, and federal requirements.

2. All antenna installations must be grounded to meet all applicable codes.

3. Safety cable kits consisting of a 3/16 EHS safety cable (3990 lbs. ultimate strength) with six clamps to secure mount and/or ballast are available as an option. Use three cable clamps at each connection with u-bolt at the end of the cable.

4. Roof pads are available as an option, Part No. 0800-386 (AAGM 2.4M NPMM PADS).

5. Hardware is provided.

6. Inspect mount, antenna and tightness of hardware at six month intervals.

7. For assistance in determining ballast requirements refer to chart in section 3.

8. All metal parts are hot dipped galvinized after fabrication.

1.1 UNPACKING & INSPECTION

1. UNPACKING & INSPECTING
The mount should be unpacked and inspected at the earliest date to ensure that all material has been recieved and is in good condition. A complete packing list for each major component is supplied.

2. FREIGHT DAMAGE
Any damage to materials while in transit should be immediately directed to the freight carrier. He will instruct you on the matters regarding any freight damage claims.

3. MATERIAL - MISSING OR DAMAGED
Any questions regarding missing or damaged materials that is not due to freight carrier should be directed to Prodelin's Customer Service Department at:

PRODELIN CORPORATION
P.O. Box 368
1700 N.E. Cable Drive
Conover, North Carolina 28613-368
(704) 464-4141

1.2 SUGGESTED TOOL LIST

1. SITE PREPERATION TOOLS

The following tools are suggested for site preperation.

1. Shovel (for ground installation)
2. Broom

2. SUGGESTED TOOL LIST

The following tools are suggested for the 2.4 NPMM Mount installation.

1. Rachet
2. Socket, 3/4"
3. Wrench, combination 3/4"
4. Tape measure
5. Torque wrench

1.3 PARTS LIST

PARTS LIST

ITEM	DESCRIPTION	QTY	LENGTH	PART NO.
1	ANGLE, BEARING	2	16.5	FY105
2	ANGLE, BASE - DIAGONAL	6	91.9	FY103
3	ANGLE, BASE - SHORT	6	74.4	FY122
4	ANGLE, BASE - LONG	6	91.3	FY121
5	ANGLE, KNEE BRACE	6	66.0	FY104
6	CLIP, BASE ANGLE MOUNTING	24		FY52
7	MAST	1		FYS96
8	BOLT, HHCS 1/2-13 x 1.50	62		FYS115
9	NUT, HEX 1/2-13	62		FYS114

2.0 ASSEMBLY INSTRUCTIONS

2.1 Locate site of installation and clear an area of 17 x 17 square feet of all debris and level if required.

2.2 If using rubber pads, place rubber pads on cleared area to form a hexigon area. See figure 2.1-1.

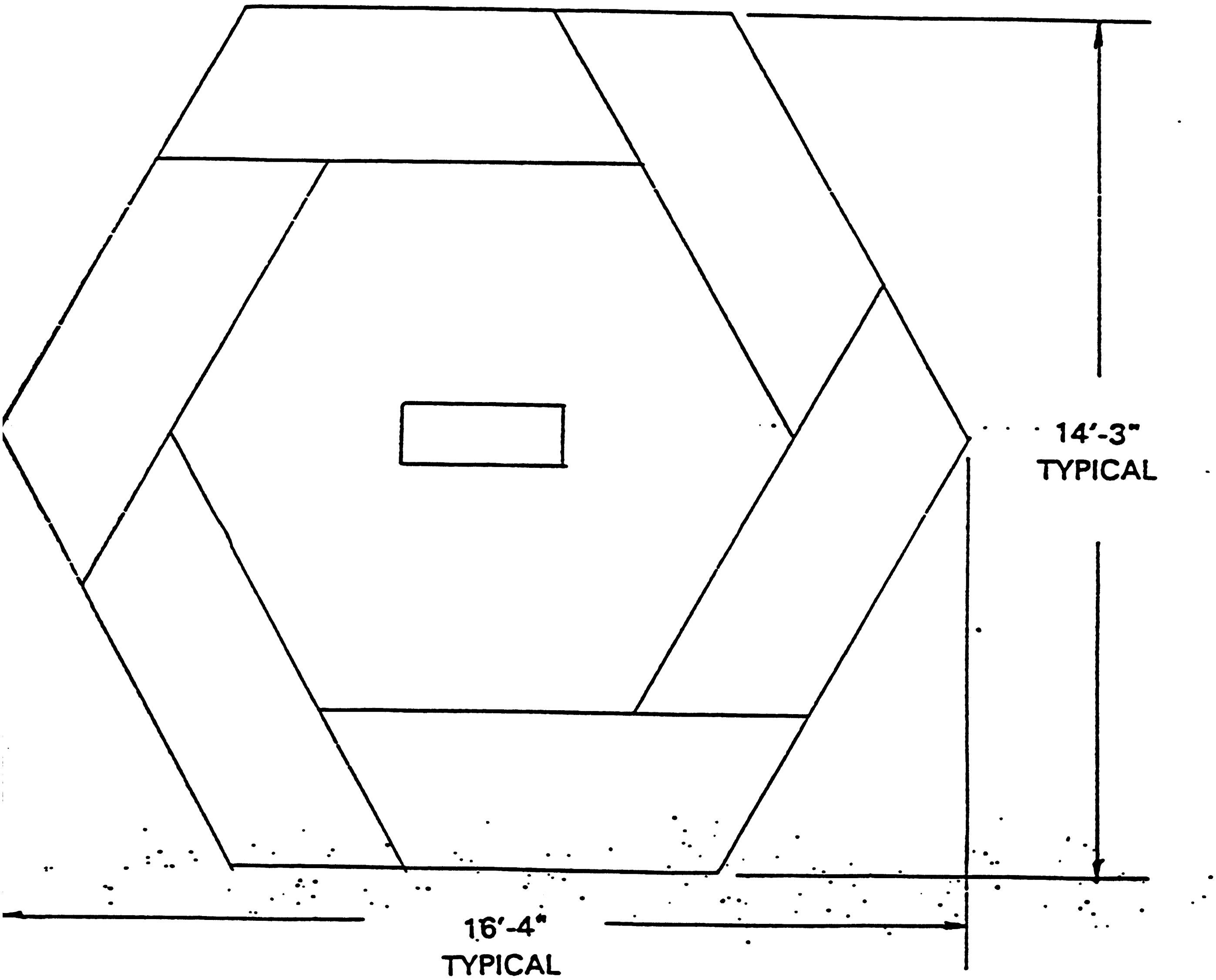
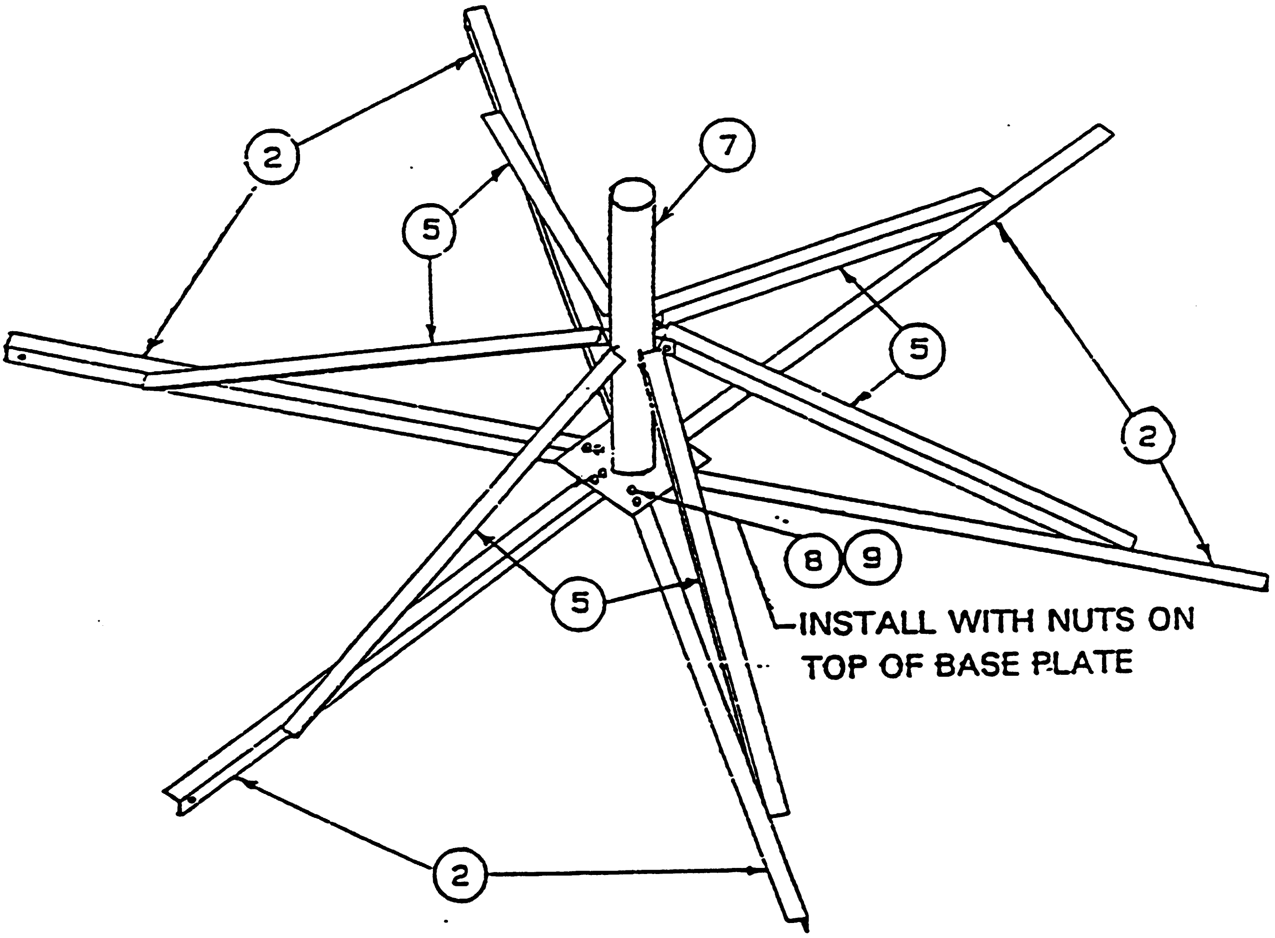
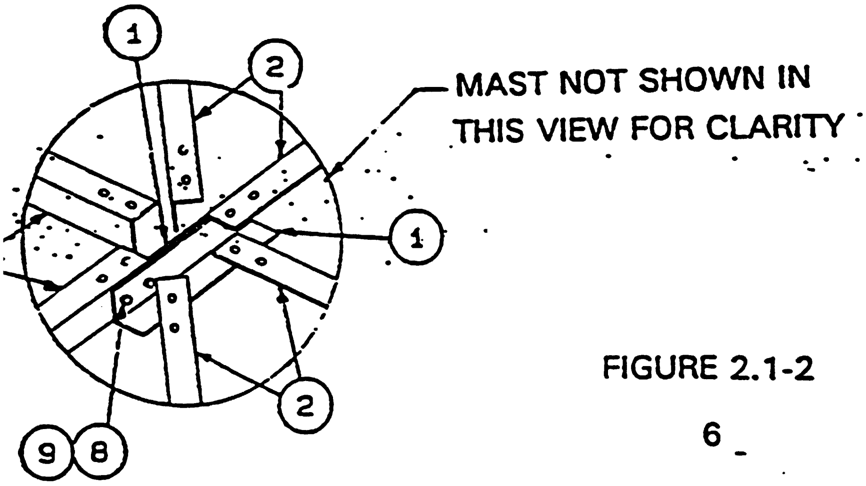


FIGURE 2.1-1

2.3 Layout diagonal base brace angles (item 2), mast support bearing angle (item 1), mast (item 7), and angle knee braces (item 5) in a spoke shape as shown in figure 2.1-2. Loosely install 1/2 -13 x 1.50 hex bolts and nuts (items 8 and 9).





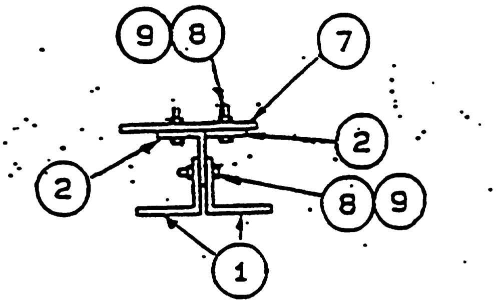
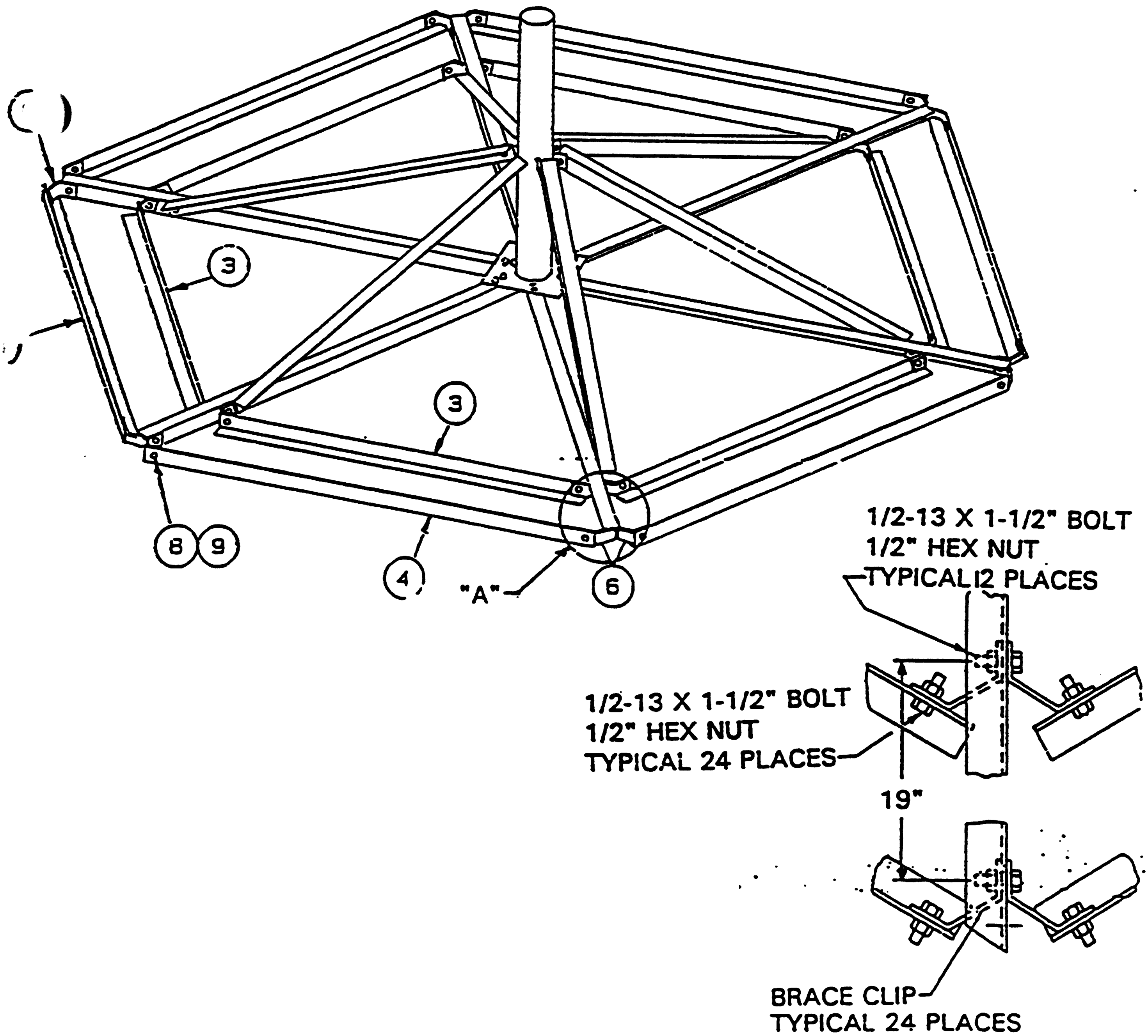


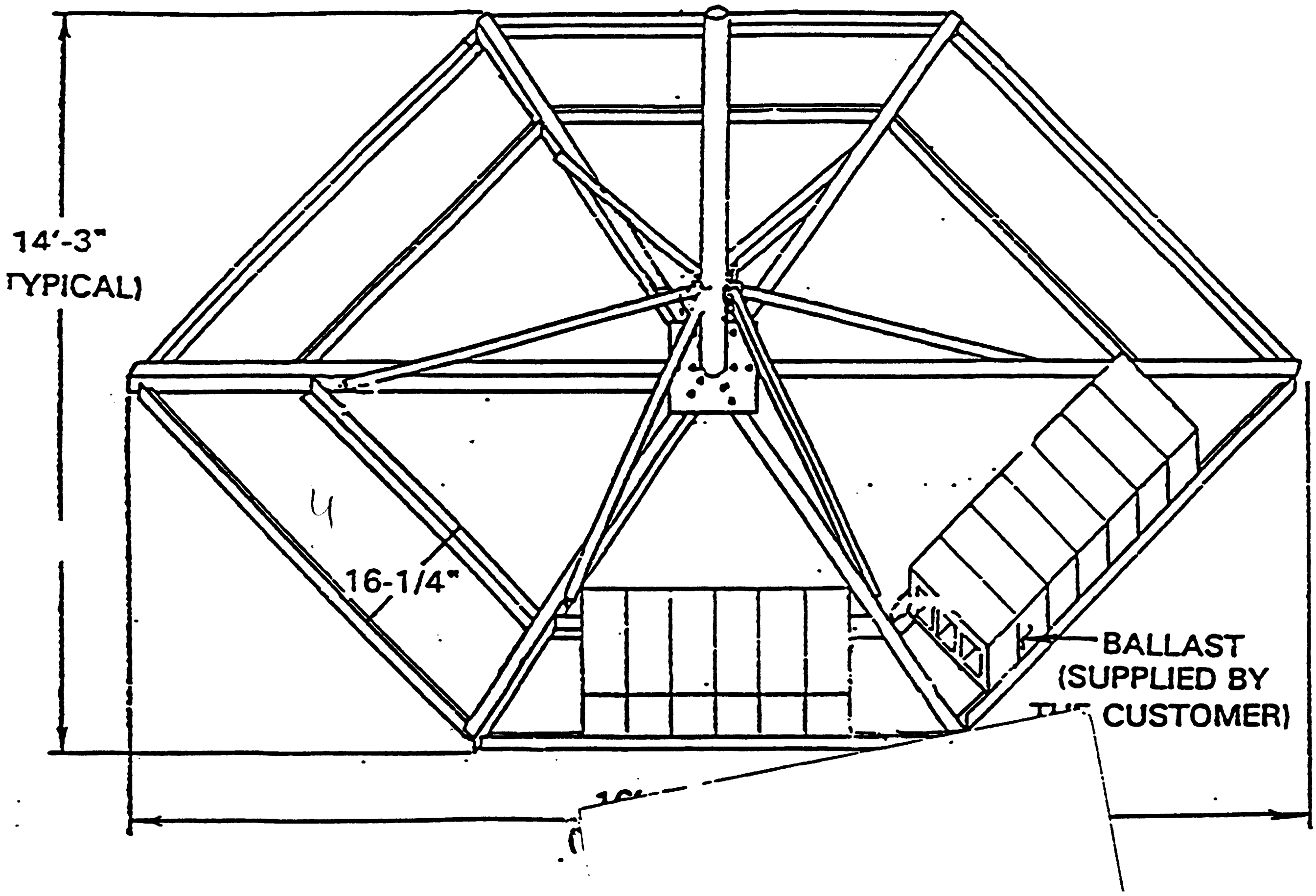
FIGURE 2.1-2

2.4 Layout long base angles (item 4) and short base angles (item 3) with angle mounting clips (item 6). Loosely install bolts and nuts(items 8 and 9). See figure 2.1-3. Ensure that frame is square. Tighten all hardware to 50 ft.-lbs when dry or 35 ft.-lbs. when lubricated.



DETAIL "A"

2.5 Add ballast, figure 2.1-4. See section 3 for ballast requirements, then install antenna system to frame following instructions that come with antenna system.



SECTION III

3.0 BALLAST REQUIREMENTS TABLE

ANTENNA DIAMETER	BALLAST (LBS.)	ZERO VELOCITY LOAD (PSF)	DESIGN WIND VELOCITIES COEFFICIENT OF FRICTION = .50		
			EL=0	EL=20	EL=40
4 FT. (1.2m)	1000	6.0	135	91	93
	1500	9.5	164	111	114
	2000	12.0	187	128	132
	2500	15.0	207	143	147
	3000	18.0	225	157	161
	3500	21.0	240	170	174
	4000	24.0	250	181	186
	5000	30.0	250	203	208
	6000	36.0	250	222*	228*
6 FT. (1.8m)	1000	6	90	60	67
	1500	9	109	74	82
	2000	12.0	125	85	95
	2500	15.0	138	96	106
	3000	18.0	150	105	116
	3500	21.0	160	113	125*
	4000	24.0	165	121	134*
	5000	30.0	165	135	150*
	6000	36.0	165	148*	164*
8 FT. (2.4m)	1000	6	68	47	50
	1500	9	82	57	62
	2000	12	94	66	71
	2500	15	104	74	79
	3000	18	112	81	87
	3500	21	120	87	94
	4000	24	125	93	101
	5000	30	125	104	112
	6000	36	125	114	123

SECTION III

3.1 BALLAST REQUIREMENT INFORMATION

3.1-1. Ballast requirements are provided to assist in determining the applicabality of the 2.4m NPMM for an antenna installation. Refer to pages UNR-Rohn Engineering Report 870101 dat4ed January 25,1988 for the test data used to generate the ballast requirements indicated. The ballast data should not be relied upon without competent local professional examination and verification of its accuracy and suitability for a specific site or application.

3.1-2. Ballast requirements are based on typical ANSI/EIA-222-D paraboloid antennas supported 12 inches from the vertex of the antenna on a 54 inch long mounting pipe on a flat supporting surface. The vertex of the antenna is assumed to be at the top of the mounting pipe. Specific antenna types may require more strength and ballast requirements and must be investigated for each installation. The load carrying requirements of the supporting surface, the mast, the antenna and the antenna's connection to the mast must also be investigated for each installation.

3.1-3. The ballast weights indicated are net ballast weights, and must be uniformly distributed over all panels. The weight of the mount and antenna may be considered as ballast, however, the uplift component of wind load must be deducted. (Worst case lift wind load component = $.000910(A)(V)^2$ at an 80 degree elevation angle.

3.1-4. The zero velocity roof loads shown are equal to the ballast weights divided by the total area enclosed by the perimeter of the mount (i.e. an area greater than the ballast pan contact area). Total roof loads would include wind forces and moments, weights of ballast, mount, antenna and roof pads. (Worst case download wind component = $.003374(A)(V)^2$ at a 60 degree elevation angle.

3.1-5. Maximum wind velocities are based on a minimum 1.5 factor of safety against structural failure and overturning for the worsdt case antenna elevation angle. The wind speeds which maay occur at an installation must be determined on an individual site basis.

3.1-6. The tabulated wind velocities resulting in sliding are based on a factor of safety (F.S.) equal to 1.0 and a coefficient of friction (u) equal to .50. A 1.0 factor of safety was used assuming that in the event of higher wind velocities, safety cables or other suitable attachments to the support structure would prevent sliding beyond a safe, designated area. Wind velocities are given for 0, 20, and 40 degree antenna elevation angles. The .50 coefficient of friction value was determined from full-scale load tests using wet UNR-Rohn roof pads on wet troweled finished concrete. The appropriate coefficient of friction and factor of safety to determine wind velocities resulting in sliding must be determined on an individual site basis. Wind speeds resulting in sliding for other factors of safety or for to the coefficients of friction may be found by multiplying the wind speed resulting in sliding by the following factor:

$$\left[\frac{\mu}{.5(F.S.)}\right]^{1/2}$$

μ = Coefficient of Friction
F.S. = Factor of Safety F.S.

3.1-7. UNR-Rohn recommends that mallast material always be placed prior to mounting the antenna and that roof pads and mounts be secured to prevent hazards from occuring under extreme wind loading conditions. Coverings over ballast pans are also recommended to prevent the inadvertent removal of ballast material after installation.

3.1-8. Roof pads are recommended to prevent damage to roof membranes. pads should be placed under all ballast pans and under the mast pipe. When roof pads are utilized, the minimum coefficient of friction between the ballast pans and roof pad or between the roof pads and the supporting surface must be used to calculate the wind speeds resulting in sliding.

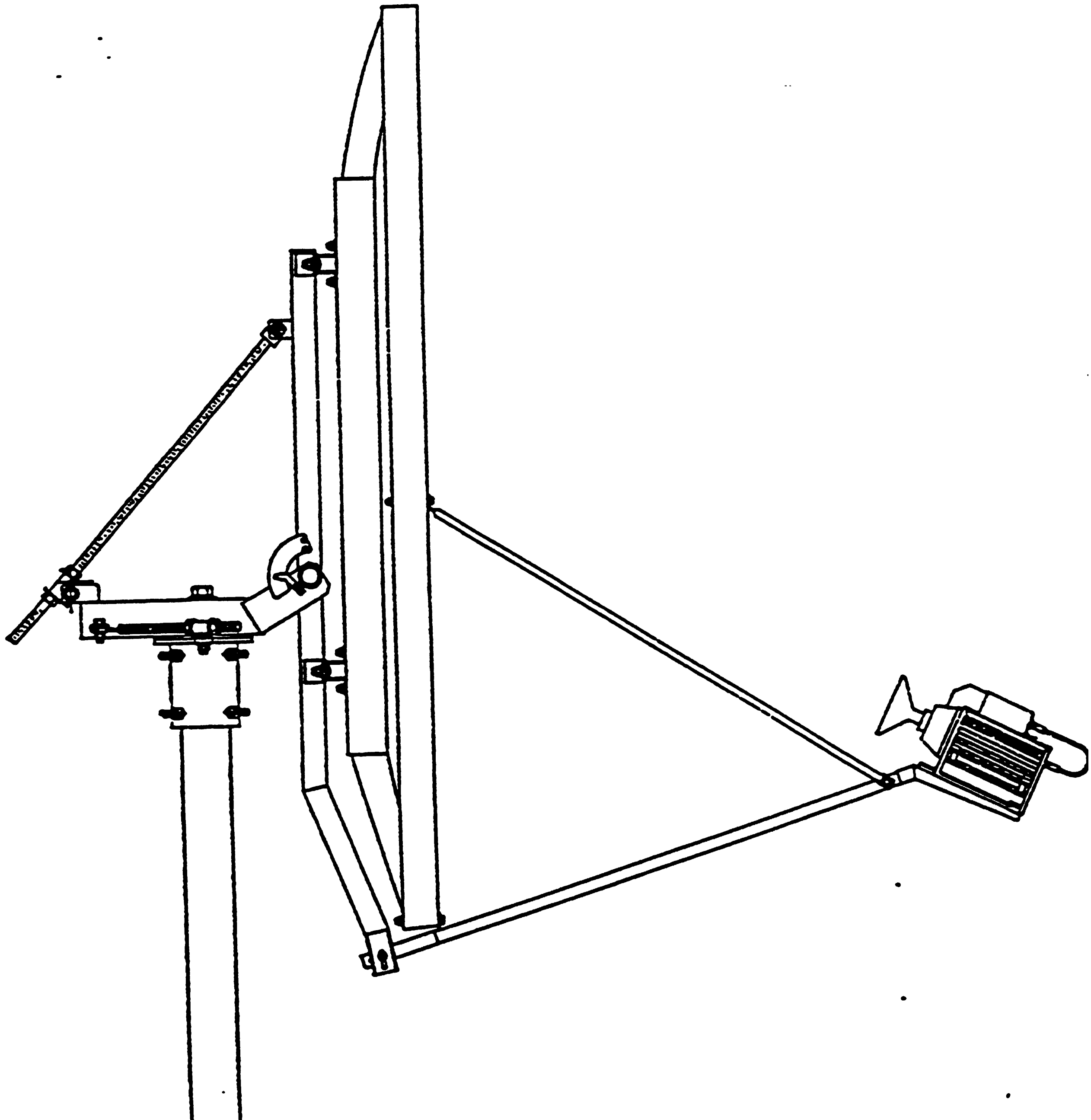
3.1-9. When adhesive, sealants or pads are utilized, they must be compatible with the supporting surface. They must also be durable and have adequate strength. Precautions should also be taken to insure that damage to the supporting surface will not occur upon wind loading.

3.1-10. Adhesives and sealants must be capable of resisting shear; otherwise, they may act as a lubricant and decrease the effective coefficient of friction between the ballast pans and the supporting structure. Windward ballast pans may lift off at wind velocities below the maximum wind velocity indicated. Adhesives and sealants may be disturbed under such circumstances and require repairing after major wind loading events.

3.1-11. The installation, roof materials and supporting structure must be capable of withstanding all loads imposed by the antenna system. Supporting structure, anchors and/or safety cables must be sufficient to resist the reactions from the antenna system. The installation must meet all applicable, local, state and federal requirements. Due to the many variables involved, Prodelin Corporation does not accept responsibility for verifying the applicability of the 1.8m NPMM for specific installation.

1.8M SERIES 1184 ANTENNA SYSTEM

TABLE OF CONTENTS



SECTION 1

GENERAL INFORMATION

1.0 INTRODUCTION

This manual describes the assembly and installation of Prodelin's 1.8M Rx/Tx offset antenna system with an Az/El mount (series number 1184). The Prodelin 1.8M is a rugged, reliable antenna system, which will operate in the 11.7 to 12.2 and 14.0 to 14.5 GHz frequency bands for Ku-Band systems and 3.7 to 4.2 and 5.925 to 6.425 GHz frequency bands for C-Band systems with high efficiency and at the same time successfully withstand the effects of the environment.

These instructions are listed by sections that cover all areas of assembly and installation. Additional sections are included in the manual to provide information on antenna alignment to the satellite and maintenance.

1.1 UNPACKING AND INSPECTION

The antenna containers should be unpacked and inspected at the earliest date to ensure that all material has been received and is in good condition. A complete packing list for each major component is supplied.

1.2 FREIGHT DAMAGE

Any damage to materials while in transit should be immediately directed to the freight carrier. He will instruct you on matters regarding any freight damage claims.

1.3 MATERIAL - MISSING OR DAMAGED

Any questions regarding missing or damaged materials that is not due to the freight carrier should be directed to Prodelin's Customer Service Department at:

PRODELIN CORPORATION
1700 NE CABLE DRIVE
P.O. BOX 368
CONOVER, NORTH CAROLINA 28613
(704) 464-4141

1.4 SUGGESTED TOOL LIST

The following tools are suggested for the antenna installation.

TOOL LIST		
TOOL	**USED ON**	**TORQUE**
RATCHET, 1/2" DRIVE		
SOCKET, 9/16" DEEP WELL	3/8" HARDWARE	20 FT/LBS
SOCKET, 3/4" DEEP WELL	1/2" HARDWARE	50 FT/LBS
WRENCH, 5/16" COMBINATION	#10 HARDWARE	FLATTEN LOCK WASHERS
WRENCH, 1/2" COMBINATION	5/16" HARDWARE	11 FT/LBS
WRENCH, 9/16" COMBINATION	3/8" HARDWARE	20 FT/LBS
WRENCH, 3/4" COMBINATION	1/2" HARDWARE	50 FT/LBS
WRENCH, 1-1/8" COMBINATION	3/4" HARDWARE	160 FT/LBS
WRENCH, 1-1/2" COMBINATION	1" HARDWARE	220 FT/LBS

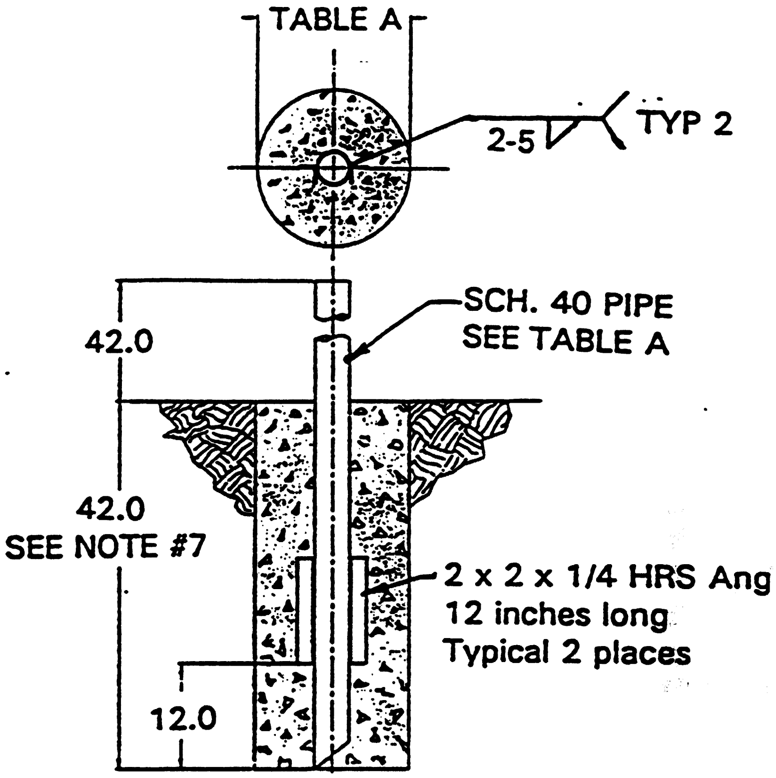
1.5 MECHANICAL ALIGNMENT TOOLS

The following tools are suggested for the initial alignment to the satellite.

1) COMPASS
2) INCLINOMETER
3) 10" CRESCENT WRENCH
4) SCREWDRIVER, STANDARD BLADE

1.6 SUGGESTED MAST & FOUNDATION

TABLE A		
IPE IZE	OUTSIDE DIAMETER	FOUNDATION DIAMETER
·1/2	4	24



NOTES:

1. 2 x 2 x 1/4 HRS Angle and schedule 40 pipe should conform with ASTM A36 and ASTM A53 Type E and S Grade B.
2. All concrete should conform to building code standards and have a minimum compressive strength of 3000 PSI at 28 days. (Per ACI-318-77)
3. Soil bearing capacity should be no less than 2000 PSF.
4. Concrete should be poured against undisturbed soil.
5. Allow concrete 24 hours set time before installation of antenna.
6. The antenna should be properly grounded to meet applicable local codes.
7. Minimum depth as shown or extend to local frost line.
8. Foundation meets the design requirements as set forth by the uniform building code. (1982 edition)

(PRODELIN CORPORATION DOES NOT REPRESENT OR WARRANT THAT ANY PARTICULAR DESIGN OR SIZE OF FOUNDATION IS APPROPRIATE FOR ANY LOCALITY OR EARTH STATION INSTALLATION.)

SECTION II

ANTENNA ASSEMBLY

CAUTION: During the assembly procedure, the sequence of instructions must be followed. **DO NOT TIGHTEN ANY HARDWARE UNTIL INSTRUCTED.**

2.0 ASSEMBLY OVERVIEW

The 1.8 meter antenna system consists of four (4) major components:

1). REFLECTOR

2). REFLECTOR SUPPORT ASSEMBLY (reflector support angle and elevation bracket).

3). Az/El POSITIONER

4). FEED SUPPORT STRUCTURE

The interface from the ground foundation to the antenna is a vertical 3.5" schedule pipe (4.0" O.D.). It is assumed that the foundation and pipe have been properly installed.

2.1 ASSEMBLY PROCEDURE

1) Place the canister on the mast pipe, loosely install 1/2-13 x 1-1/2" long square head cup point set screw and nut assemblies. The canister must be positioned as shown in Figure 2.1-1 in relation to the satellite arc. Tighten 1/2" bolts and jam nuts at this time. Reference Figure 2.1-1. NOTE: A grounding cable (if required) can be attached to one of the 1/2" bolts.

2) Place the positioner on the canister and loosely attach with 1-8 x 5.0" long bolt, flat washer and lock washer. Reference Figure 2.1-2.

3) Assemble Azimuth and Elevation adjustment rods. Reference Figure 2.1-3.

3.1 Azimuth adjustment assembly: Run 3/4-10 nut approximately half way onto the azimuth adjustment rod, place azimuth tube and another 3/8-10 nut onto the rod. Leave the nuts loose at this time.

3.2 Elevation adjustment assembly: Run a 3/4-10 nut approximately 6 inches onto the elevation adjustment rod, add 1 flat washer, elevation adjustment block, 1 flat washer and another 3/4-10 nut to the rod. Leave the nuts loose at this time.

4) Place the azimuth tube over the end hole in the canister plate and attach with 1/2-13 x 1.00" bolt, flatwasher and lockwasher. Rotate positioner where the hole in the azimuth rod and the hole in the tab on the side of the positioner are lined up. Attach the azimuth rod to the positioner using a 1/2-13 x 1.50" long bolt, flatwasher, spacer .385" long, flatwasher, lockwasher and nut. Reference Figure 2.1-4. At this time tighten azimuth adjustment hardware.

5) Attach the azimuth pointer to the holes in the side of the positioner using two (2) #10 x .50" self tapping screws, flatwashers and lockwashers. Reference Figure 2.1-5. NOTE: Tighten only until lock washers are flattened.

6) Place the reflector support tube between the tabs on the front of the positioner and secure with the 1-8 x 6" long bolt, flatwasher, lockwasher and nut. place the tab of the elevation adjustment rod to the tab on the reflector support tube, attach using 1/2-13 x 1.5" bolt, flatwasher, .575" long spacer, flatwasher, lockwasher and nut. Place the elevation adjustment block between the tabs on the rear of the positioner, assemble with 1/2-13 x 2.00" long bolt, flatwasher, 1.60" spacer, flatwasher, lockwasher, and nut. Reference Figure 2.1-6.

7) Attach the elevation marking plate to the reflector support tube, place the spacers between the reflector support tube and the elevation marking plate. Mount with (2) #10 x 1.00" self-tapping screws. flatwasher, and lockwasher, and nut. Reference figure 2.1-7. Note: Tighten only until lock washers are flattened.

8) Attach the elevation pointer to the tab on the front of the positioner using (2) #10 x .50" self-tapping screws, flatwashers, and lockwashers. Reference 2.1-7. Note: Tighten only until lockwashers are flattened.

9) Attach the reflector cross arms to the reflector support tube with 1/2-13 x 1-1.50" carriage bolts, flatwashers. lockwashers and nuts. Reference Figure 2.1-8. Note the orientation of the reflector mounting holes, the inner most holes on the cross am flanges will be to the top and the bottom of the reflector.

10) To install the reflector back structure, have the reflector face up on the ground, locate the top of the reflector and insert (2) 3/8-16 x 5.00" long bolts in the inner most holes. With a person on each side of the reflector, lift the reflector up and insert the 2 bolts thru the top holes in the reflector cross arms. Loosely attach hardware with flatwashers, lockwashers, and nuts. NOTE: The reflector is fully supported at this time. The 5.00" long bolts are for the top of the reflector and the 4.50" long bolts are for the bottom of the reflector. Reference Figure 2.1-9. Tighten all reflector mounting hardware per torque specs on page 4.

11) Using the torque specifications given in the suggested tool list, tighten all reflector and mount hardware, with the exception of the 1/2" carriage bolts. Install feed support and line up the reflector and feed. Torque 1/2" carriage bolts per torque specs on p[age 4.

1.8 METER AZ/EL PARTS LIST

ITEM	DESCRIPTION	PART NO.	QTY
1	CANISTER	0490-322	1
2	1/2-13 X 1.5 SQ. HD CUP POINT SCREW ASS'Y	8317-102	6
3	1/2-13 HEX NUT	8104-007	8
4	POSITIONER	0490-252	1
5	1-8 X 5.0" BOLT	8036-040	1
6	1-8 X 6.0" BOLT	8036-048	1
7	1" FLAT WASHER	8201-049	3
8	1" LOCK WASHER	8202-046	2
9	1-8 HEX NUT	8107-007	1
10	#10 X .50" SELF TAPPING SCREW	8321-007	4
11	#10 X 1.00" SELF TAPPING SCREW	8321-006	2
12	#10 SPACER	0159-220	2
13	#10 FLAT WASHER	8201-037	6
14	#10 LOCK WASHER	8202-032	6
15	AZIMUTH POINTER	0211-496	1
16	ELEVATION POINTER	0211-497	1
17	ELEVATION MARKING PLATE	0156-572	1
18	ELEVATION ROD	0490-144	1
19	ELEVATION BLOCK	0168-112	1
20	AZIMUTH ROD	0490-143	1
21	AZIMUTH TUBE	0211-453	1
22	3/4-14 HEX NUT	8106-007	4
23	3/4" FLAT WASHER	8201-047	2
24	1/2-13 X 1.00" BOLT	8033-008	1
25	1/2-13 X 1.50" BOLT	8033-012	1
26	1/2-13 X 2.75" BOLT	8033-022	1
27	1/2-13 X 1.50" CARRIAGE BOLT	8043-012	4
28	1/2" FLAT WASHER	8201-043	9
29	1/2" LOCK WASHER	8202-043	7
30			
31	SPACER, ELEVATION, 1.60" LONG	0162-168	1
32	SPACER. ELEVATION, .525" LONG	0162-167	1
33	REFLECTOR CROSS ARMS	0211-417	2
34	REFLECTOR SUPPORT TUBE	0490-251	1
35	3/6-16 X 4.50" BOLT	8032-036	4
36	3/8-16 X 5.00" BOLT	8032-040	4
37	3/8" FLAT WASHER	8201-042	16
38	3/8" LOCK WASHER	8202-042	8
39	3/8-16 HEX NUT	8102-007	8

FIGURE 2.1-1

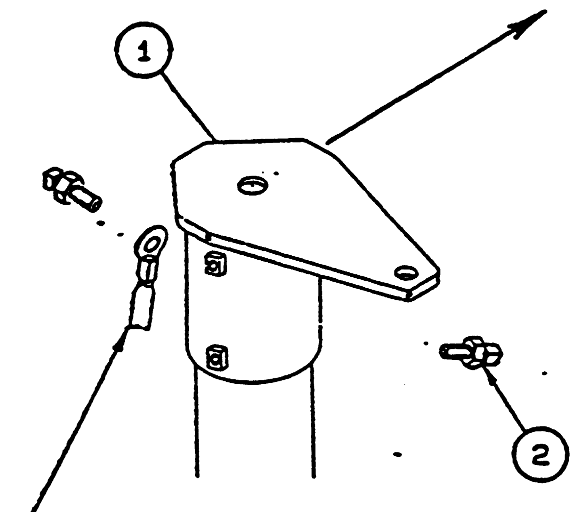


FIGURE 2.1-2

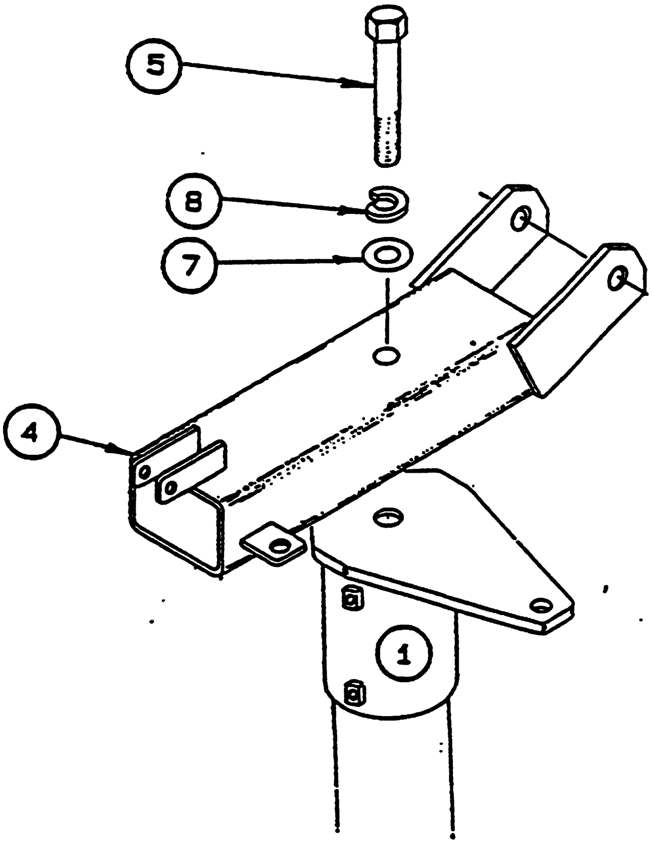
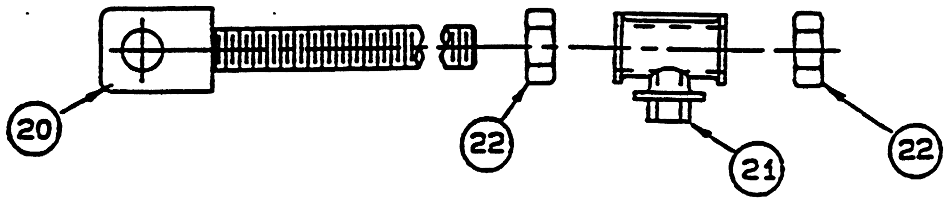


FIGURE 2.1-3

AZIMUTH ROD ASSEMBLY



ELEVATION ROD ASSEMBLY

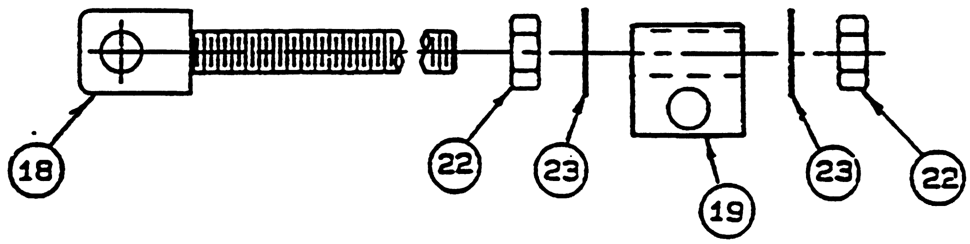


FIGURE 2.1-4

AZIMUTH ROD INSTALLATION

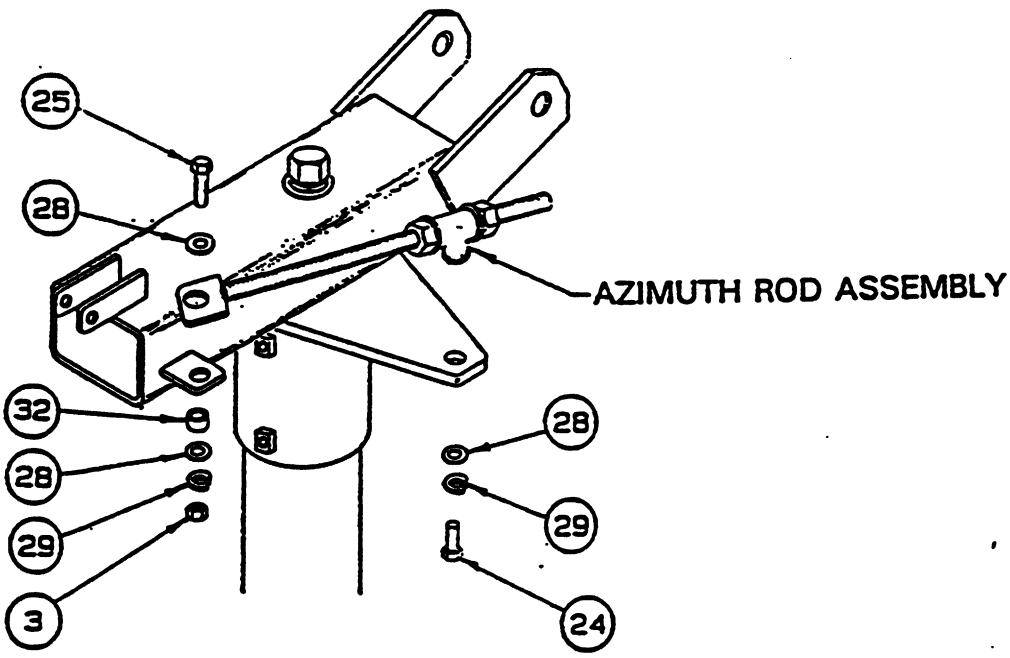


FIGURE 2.1-5
AZIMUTH POINTER INSTALLATION

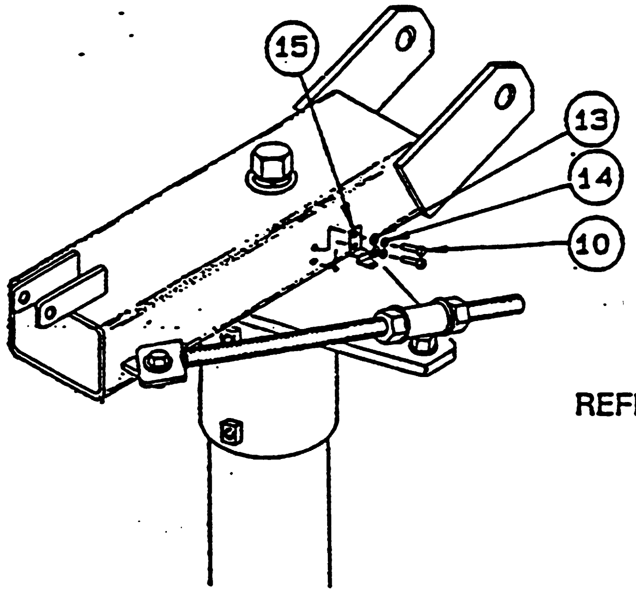


FIGURE 2.1-6
REFLECTOR SUPPORT ASSEMBLY

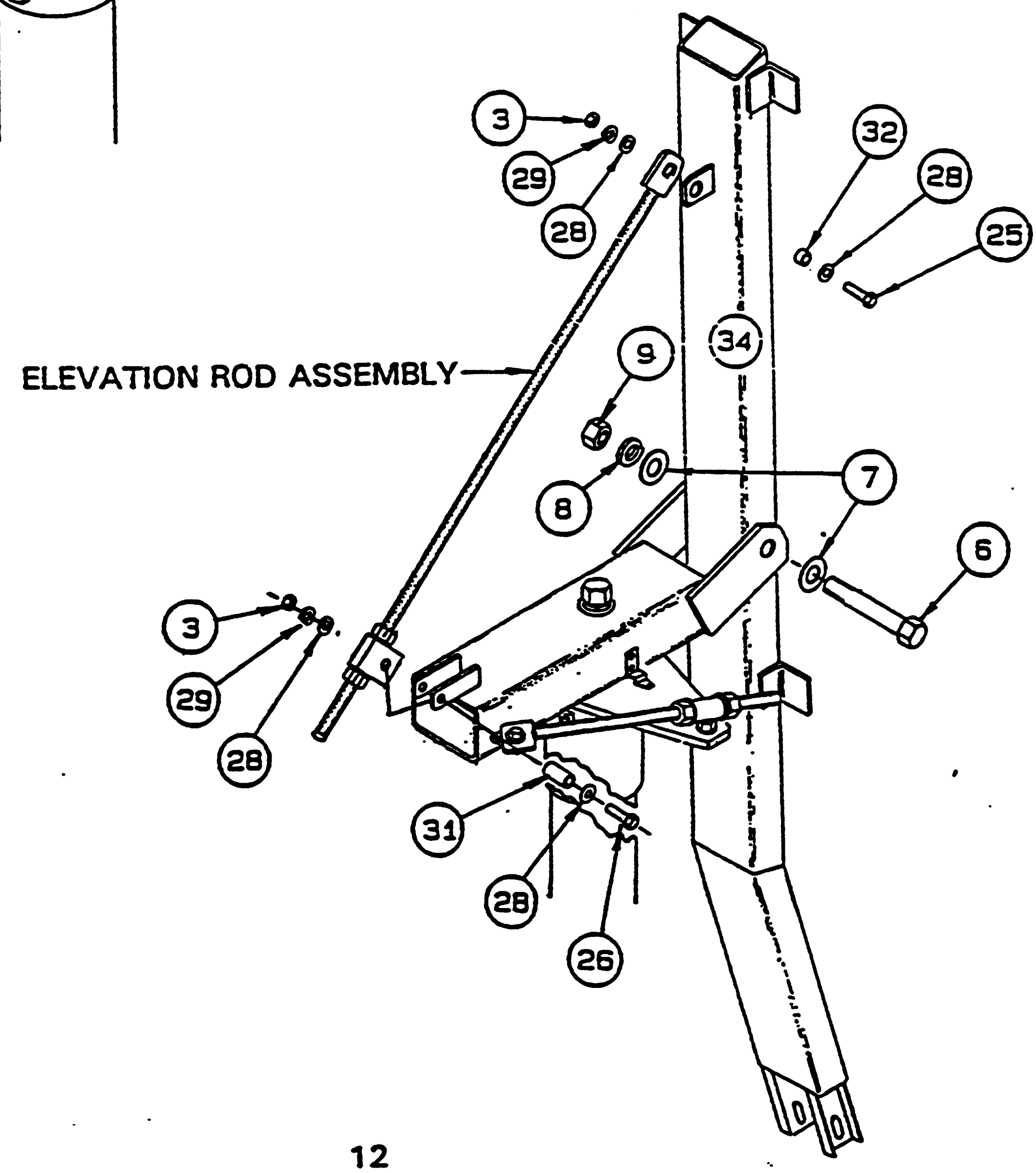


FIGURE 2.1-7

ELEVATION MARKING PLATE AND POINTER INSTALLATION

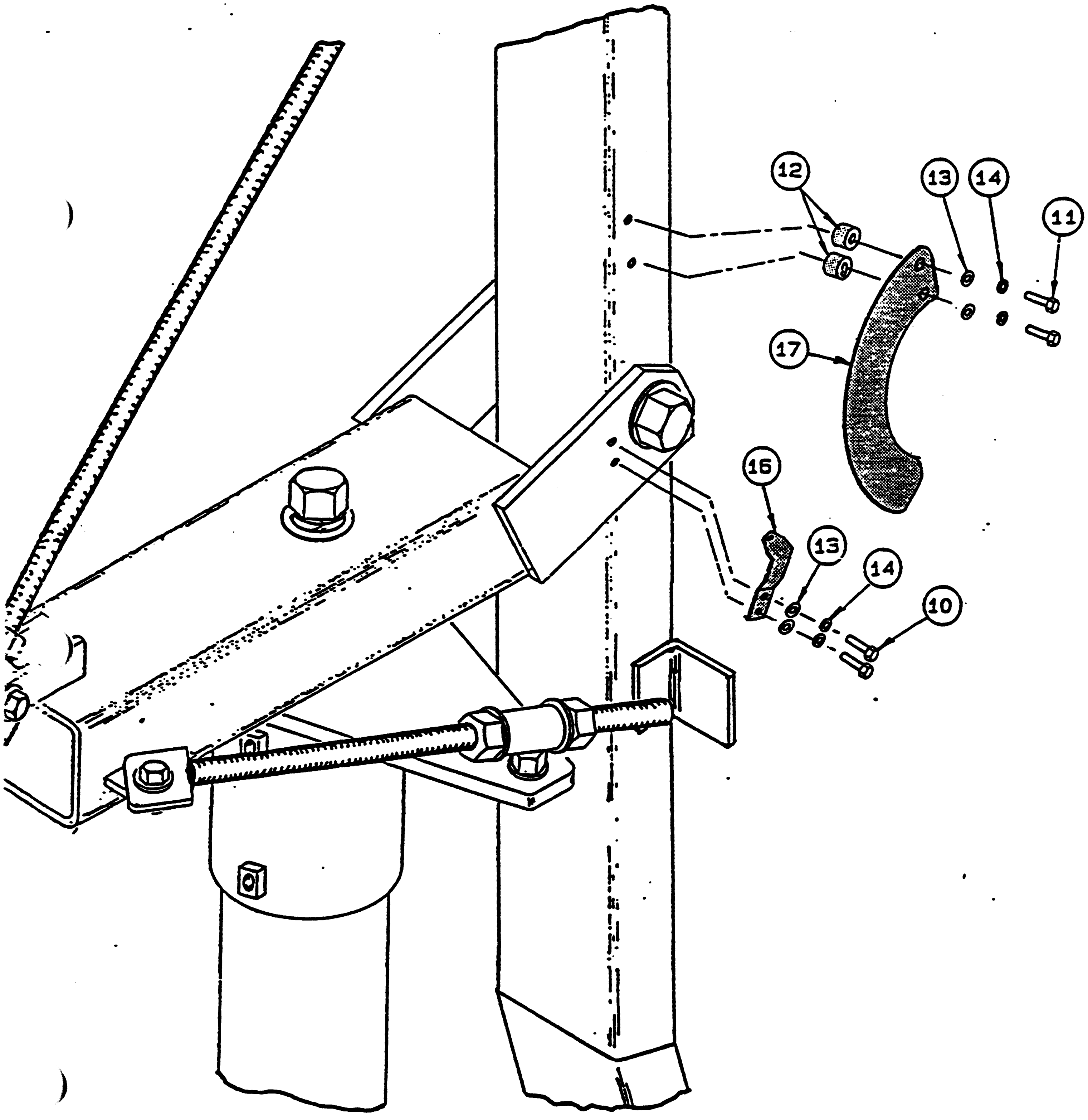


FIGURE 2.1-8

REFLECTOR CROSS ARM ASSEMBLY

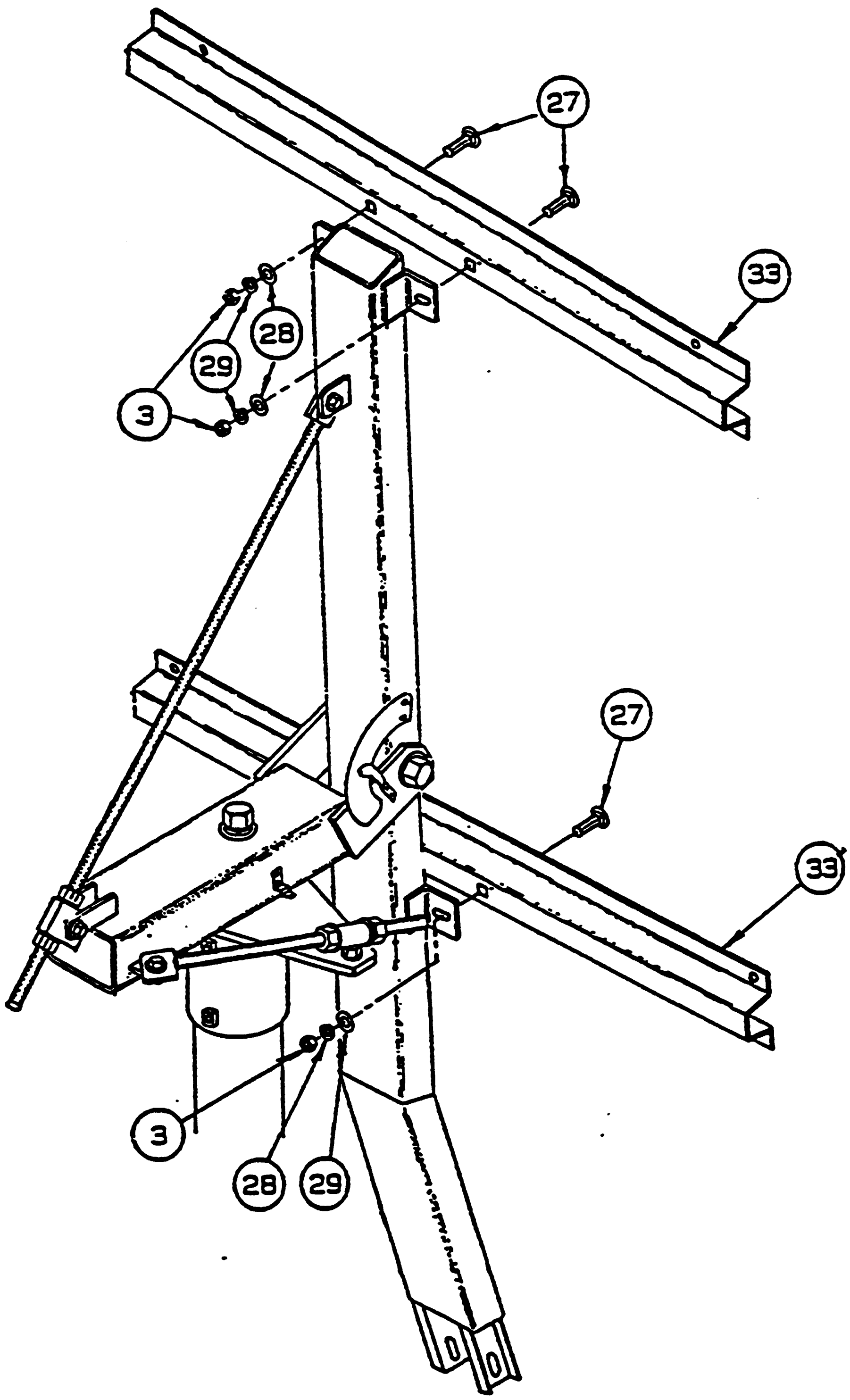
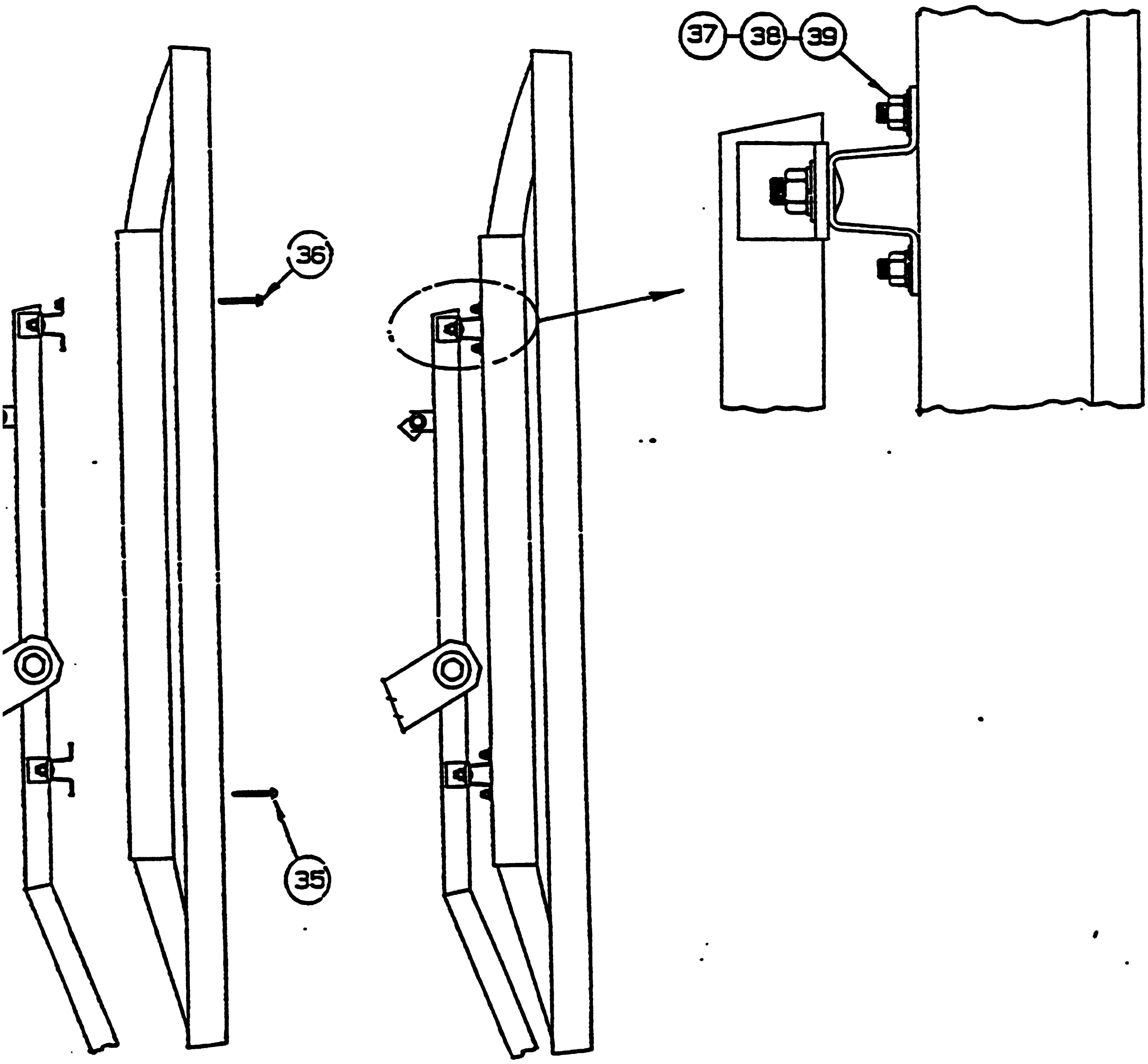


FIGURE 2.1-9

REFLECTOR MOUNTING



SECTION III

FEED SUPPORT ASSEMBLY

The following instructions are for installing a C-Band or KU Band feed support to Prodelin's 1.8 meter antenna system.

3.0 FEED SUPPORT INSTALLATION

1. Attach the right and left hand feed rods loosely to the reflector with 5/16-18 x 3.75" bolts, flat washers, lock washers and nuts. Reference Figure 3.0 and Figure 3.0-1.

2. Before attaching the feed support tube, sight the bottom of the reflector with the reflector support tube, to be sure the reflector is centered. If not, move the reflector left or right on the cross arms. Reference Figure 3.0-2.

3. Attach the feed support tube loosely to the bottom of the reflector with a 5/16-18 x 3.75" bolt, two flat washers, lock washer and nut. Reference Figure 3.0-3.

4. Attach the bottom of the feed support tube to the reflector support tube using 2, 5/16-18 x .75" carriage bolts, flat washers, lock washers and nuts. Reference Figure 3.0-4.

5. Saddle the feed support tube between the feed rods and assemble with 5/16-18 x 3.25" bolt, 2 flat washers, lock washer and nut. Reference Figure 3.0-5.

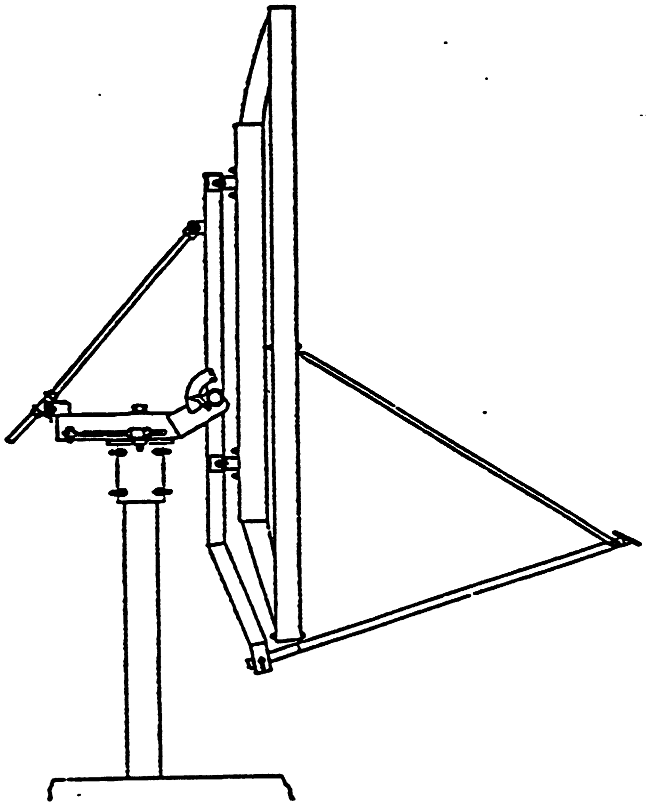
6. Tighten the 4, 1/2-13 x 1.5" carriage bolts to the reflector crossarms.

NOTE: At this time you are ready to install your C-Band or KU-Band feed system. For feed installation reference the instructions enclosed with the feed of your choice.

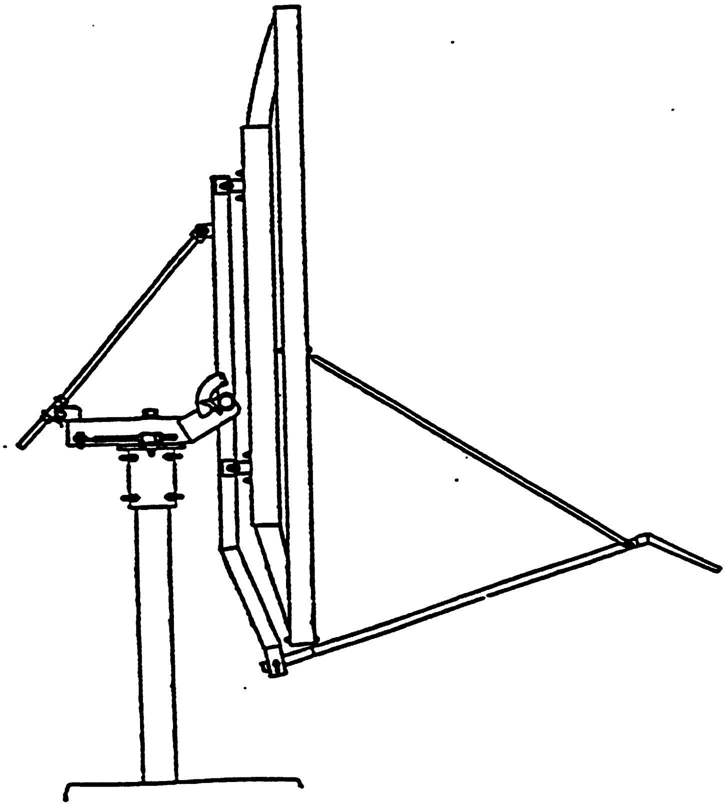
FEED SUPPORT PARTS LIST

ITEM	DESCRIPTION	PART NO.	QTY
1	FEED SUPPORT	VARIES	1
2	L. H. FEED ROD - Ku-BAND	0176-174	1
2	L. H. FEED ROD - C-BAND	0176-212	1
3	R. H. FEED ROD - Ku-BAND	0176-173	1
3	R. H. FEED ROD - C-BAND	0176-211	1
4	5/16-18 X 3.75" BOLT	8031-030	3
5	5/16-18 X .75" CARRIAGE BOLT	8038-006	2
6	5/16" FLAT WASHER	8201-041	10
7	5/16" LOCK WASHER	8202-041	6
8	5/16-18 HEX NUT	8101-009	6
9	5/16-18 X 3.25" BOLT	8031-026	1

C-BAND FEED SUPPORT



Ku-BAND FEED SUPPORT



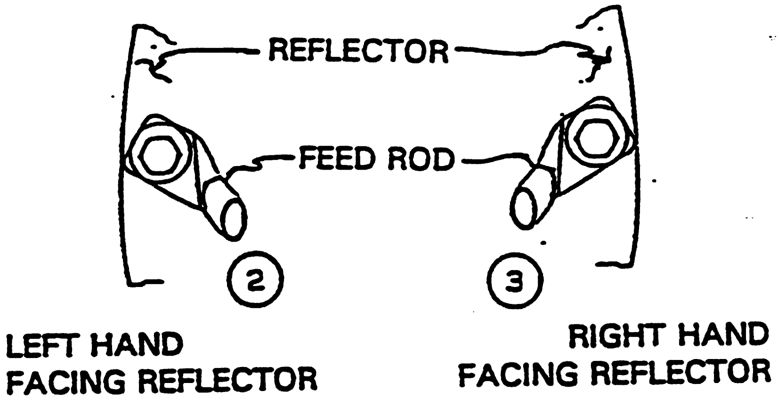


FIGURE 3.0

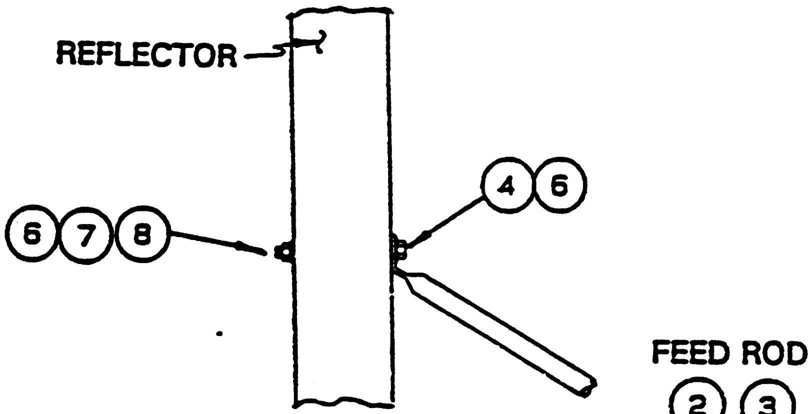


FIGURE 3.0-1

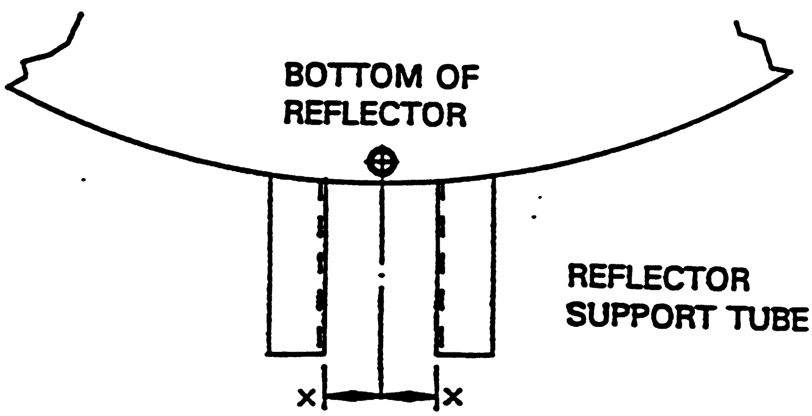


FIGURE 3.0-2

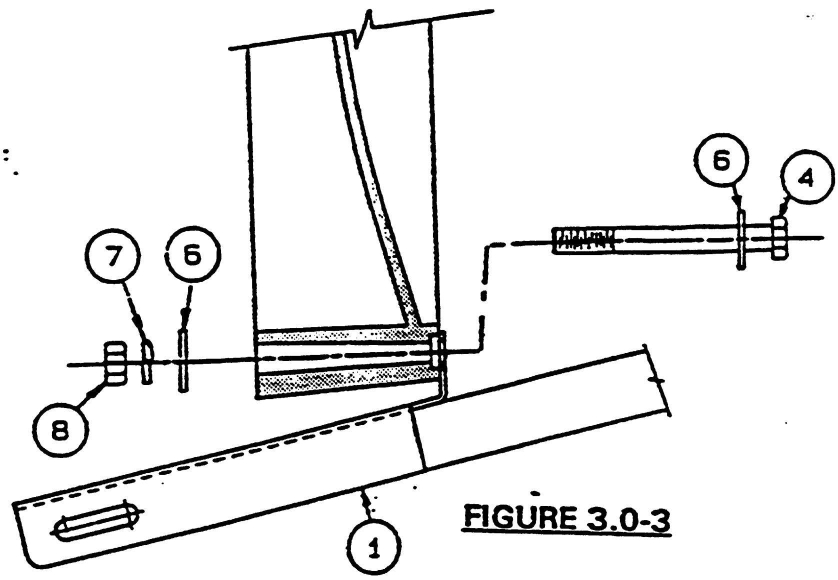


FIGURE 3.0-3

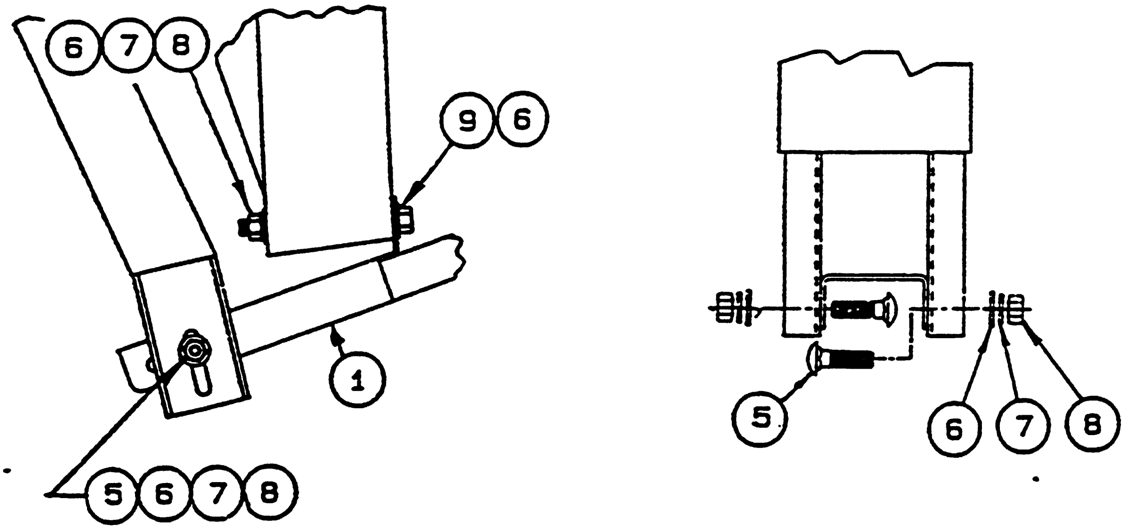


FIGURE 3.0-4

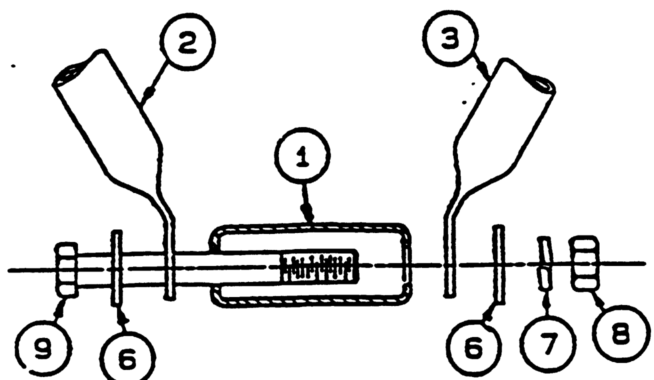


FIGURE 3.0-5

SECTION IV

ANTENNA POINTING

4.0 ALIGNMENT TO SATELLITE

Prodelin's 1.8 meter Az/El mount requires that the antenna be aligned to the satellite orbital arc initially by a trained installer, after which, any future repointing to a second satellite can be accomplished quickly and easily by anyone with a minimum of tools and instruction.

4.1 INITIAL ALIGNMENT

The 1.8 meter offset reflector contains a 22.3° elevation offset look angle. Therefore, when the reflector aperture is perpendicular to the ground, the antenna is actually looking 22.3° in elevation.

1) Aligning to primary satellite: Attach the inclinometer to the reflector support ring as shown in figure 4.1-1. This surface compensates for the 22.3° offset in the reflector, therefore a direct reading can be taken.

2) Raise or lower the antenna to find the desired elevation by turning the 3/4" nuts located at the elevation block. Position the top nut so that it will not interfere with adjustment. Turn the bottom nut clockwise to increase elevation and counterclockwise to decrease elevation.

3) After the correct elevation angle is set, rotate the antenna in azimuth by turning the 3/4" nuts located at the azimuth adjustment tube. Turn the front (near reflector) nut to decrease azimuth angle and the back nut to increase azimuth angle. Rotate azimuth until a signal is reached.

4) Peak the antenna signal by fine adjustments made in both azimuth and elevation.

5) Tighten the four (4) 3/4" nuts used for adjustments.

6) Mark satellite location: Locate the azimuth and elevation pointers, you will find a small hole in the end of the pointers, mark the canister plate and the elevation plate to identify the satellite location.

7) Aligning to secondary satellite: Loosen the 3/4" nuts on the azimuth adjustment rod, using the compass rotate the antenna in azimuth to the next satellite. Snug the 3/4" azimuth nuts at this time.

8) Loosen the 3/4" nuts on the elevation adjustment rod, place inclinometer on the angled reflector support tube, raise or lower the antenna to the new elevation. Snug the 3/4" elevation nuts at this time.

9) Peak the antenna signal by fine adjustments made in both azimuth and elevation.

10) Repeat step 6 for marking satellite location.

11) Return antenna to primary satellite by aligning azimuth and elevation pointers with the marks made in step #6. Tighten all adjustment hardware.

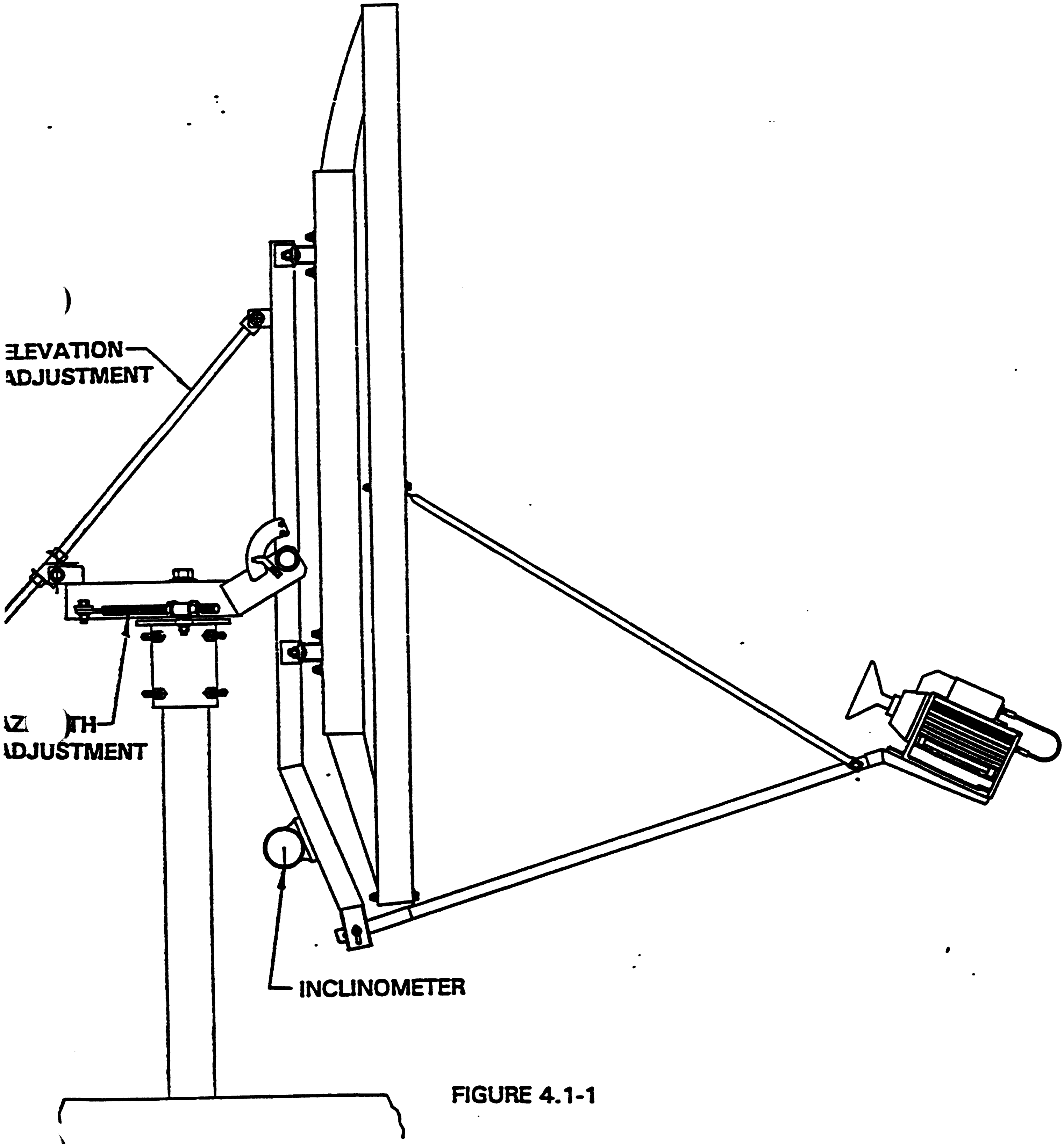


FIGURE 4.1-1

SECTION V

MAINTENANCE

5.0 MAINTENANCE OVERVIEW

After installation, the antenna requires only periodic inspection. It is anticipated that maintenance, if required, will be minimal and easily handled by a local or in-house maintenance staff. The materials used in the construction of this Earth Station Antenna virtually eliminate any maintenance repairs.

5.1 PERIODIC INSPECTION

It is suggested that a periodic inspection be performed at least every six months.

NOTE: After any very severe weather conditions, inspection of the antenna should be performed to determine if foreign objects have caused damage or if survival specifications have been exceeded.

This inspection should include the following:

1) Check all bolting locations - all bolts should be tight.

2) Check all structural members - repair or replace if damaged.

3) Check the foundation anchor bolts - they must be secure and with no failure signs in foundation.

4) Check for corrosion - on the reflector structure and mount.

5.2 REFLECTOR

Prodelin's reflector does not require any maintenance. The composite construction of the reflector is virtually impervious to any damages that could be caused by weather or other atmospheric conditions.

It is only necessary to inspect for any physical damage done by vandalism or very severe weather conditions.

Should any damage be detected to a portion of the reflector, contact the Customer Service Department at Prodelin for recommendations involving reflector repair.

5.3 MOUNT AND REFLECTOR SUPPORT STRUCTURE

The mount and reflector support structure supplied with this antenna is of steel construction and has a hot-dipped galvanized finish.

If inspection shows any signs of structural failure, the mount members that are damaged should be repaired or replaced.

Corrosion: Any corrosion on steel members may be repaired with a cold, zinc-rich galvanizing paint.

5.4 FEED AND FEED SUPPORT

The feed support system should be inspected to insure that all hardware is secure. The feed/radio mounting bolts should be tight.

The feed horn window should be inspected to insure that it is intact so that no moisture can collect inside the feed horn. Replace if damaged.

TABLE OF CONTENTS

SECTION I INTRODUCTION

1.0 GENERAL INFORMATION

This manual describes the assembly and installation of Prodelin's 2.4 meter 4 piece antenna system (Series 1244). The Prodelin 2.4 meter is a rugged, reliable antenna system, which will operate in the Ku-Band frequency with high efficiency and at the same time successfully withstand the effects of the environment.

These instructions are listed by sections that cover all areas of assembly and installation. Additional sections are included in the manual to provide information on antenna alignment to the satellite and maintenance.

1.1 UNPACKING AND INSPECTION

The system containers should be unpacked and inspected at the earliest date to insure that all material has been received and is in good condition. A complete packing list for each major component is supplied.

1.2 FREIGHT DAMAGE

Any damage to materials while in transit should be immediately directed to the freight carrier. He will instruct you on matters regarding any freight damage claims.

1.3 MATERIAL - MISSING OR DAMAGED

Any questions regarding missing or damaged materials that is not due to the freight carrier should be directed to Prodelin's Customer Service Department at:

PRODELIN CORPORATION
1700 NE CABLE DRIVE
P.O. BOX 368
CONOVER, NORTH CAROLINA 28613
(704) 464-4141

1.4 MECHANICAL INSTALLATION TOOLS

The following tools are suggested for the antenna installation.

1 ratchet, 3/8" or 1/2" drive

1 socket, 1/2" (13mm) deep well
1 socket, 3/4" (19mm) deep well
1 socket, 1-1/8" (29mm) deep well

1 wrench, combination 5/16" (8mm)
1 wrench, combination 1/2" (13mm)
1 wrench, combination 3/4" (19mm)
1 wrench, combination 15/16" (24mm)
1 wrench, combination 1-1/8" (29mm)
1 wrench, combination 1-1/2" (38mm)

1 screwdriver, standard blade
1 screwdriver, cross blade
1 10" adjustable crescent wrench
1 allen wrench, 5/32"

1 3" (76mm) wrench (socket, crescent or pipe) for 2"-4.5 bolt

1.5 MECHANICAL ALIGNMENT TOOLS

The following tools are suggested for the initial alignment to the satellite:

1 compass
1 inclinometer

SECTION II ANTENNA ASSEMBLY

CAUTION: During the assembly procedure, the sequence of instructions must be followed. **DO NOT TIGHTEN ANY HARDWARE UNTIL INSTRUCTED.**

2.0 ANTENNA ASSEMBLY

The 2.4 meter antenna system consists of four (4) major components:

1) Reflector (4 Petals)
2) Reflector Support Assembly
3) Az/El Positioner Assembly
4) Feed Support and Feed Stabilization Assemblies

The interface from the ground foundation to the antenna is a 6.63" O.D. pipe, vertical within 2 . It is assumed that the foundation and pipe have been properly installed. For a typical in-ground mast foundation design, see figure **2.0-1**, next page.

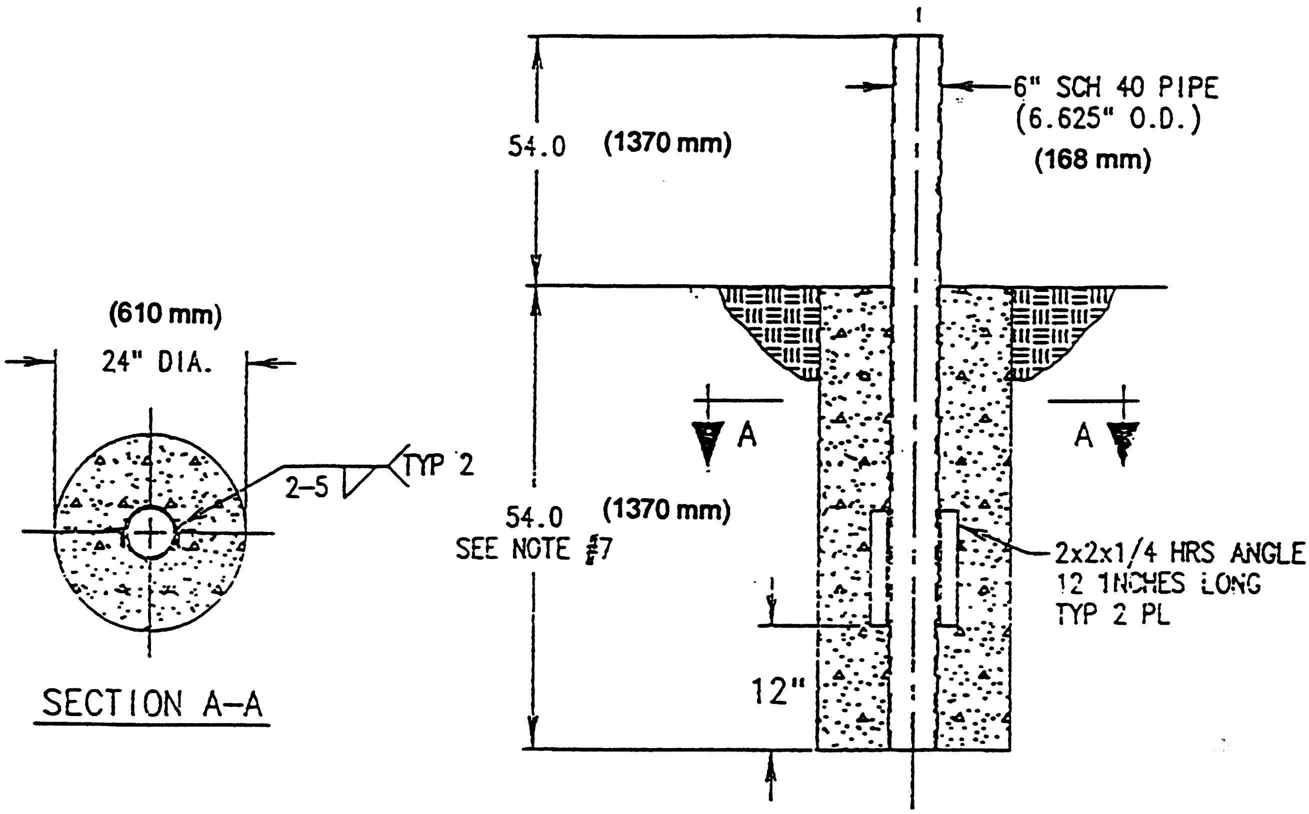
2.1 CANISTER AND Az/El POSITIONER INSTALLATION

As shown in figures **2.1-1**, place the canister assembly on the mast pipe, observing the following points:

STEP 1: Back out the (8) 5/8" set screws so that the canister can slip over the pipe. Tighten the (8) 5/8" set screws securely.

STEP 2: Loosen the 2" bolt and rotate the positioner (rectangular tube) to be at right angles to the canister plate as shown. Remove the azimuth rod from the positioner. Run one of the 1" nuts up towards the tab end of the rod; and remove the other 1" nut and one washer. Place the rod through the adjustment tube attached to the canister top plate, and replace the washer and nut. Re-attach the azimuth rod to the Az/El positioner with the 3/4-10 x 2.00" bolt, two flatwashers, lockwasher, nut and .80" sleeve. Tighten securely. Tighten the 2" bolt at this time.

STEP 3: The canister must be oriented correctly to the nominal satellite azimuth position. Loosen the set screws and rotate the canister on the pipe to the required position. Refer to figure 2.1-1. Tighten the set screws securely, and tighten the 5/8" lock nuts against the canister.

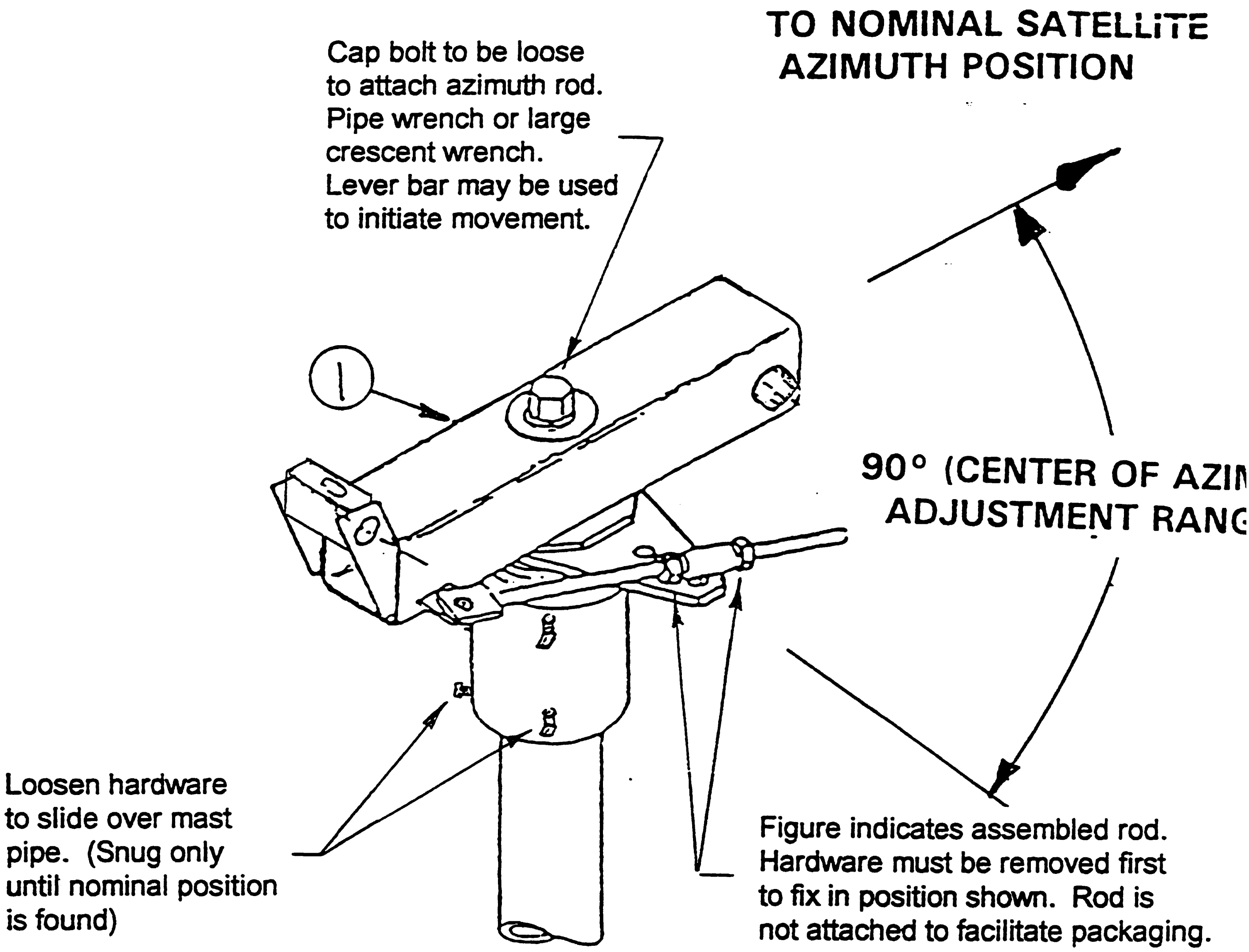


NOTES:

1. 2 x 2 x 1/4 HRS Angle and 6" schedule pipe should conform with ASTM A36 , structural steel and ASTM A53 Grade B pipe.
2. All concrete should conform to building code standards and have a minimum compressive strength of 3000 PSI at 28 days. (Per ACI-318-77)
3. Soil bearing capacity should be no less than 2000 PSF.
4. Concrete should be poured against undisturbed soil.
5. Allow concrete 24 hours set time before installation of antenna.
6. The antenna should be properly grounded to meet applicable local codes.
7. Minimum depth as shown or extend to local frost line.
8. Foundation meets the design requirements as set forth by the uniform building code. (1982 edition)

(PRODELIN CORPORATION DOES NOT REPRESENT OR WARRANT THAT ANY PARTICULAR DESIGN OR SIZE OF FOUNDATION IS APPROPRIATE FOR ANY LOCALITY OR EARTH STATION INSTALLATION.)

RECOMMENDED FOUNDATION
FIGURE 2.0-1



POSITIONER INSTALLATION

FIGURE 2.1-1

PARTS LIST
TABLE 2.1-1
(REFERENCE FIGURE 2.1-1)

ITEM#	PART#	DESCRIPTION	QTY
1	0181-691	4 Pc 2.4m Az/El Positioner Assy	1

2.2 REFLECTOR SUPPORT ASSEMBLY & REFLECTOR INSTALLATION

The reflector support assembly consists of a rectangular frame and two cross template assemblies, which provide the necessary structural support and alignment positions on which the four reflector petals are mounted.

The reflector quadrants are labeled #1,#2,#3, and #4; with #1 being the upper right quadrant when looking into the face of the reflector; #2 is lower right; #3 is lower left; and #4 is upper left. Note that each quadrant has a longer side (major axis) and a shorter side (minor axis). The quadrant number may be found molded into the back of each petal at the inside corner.

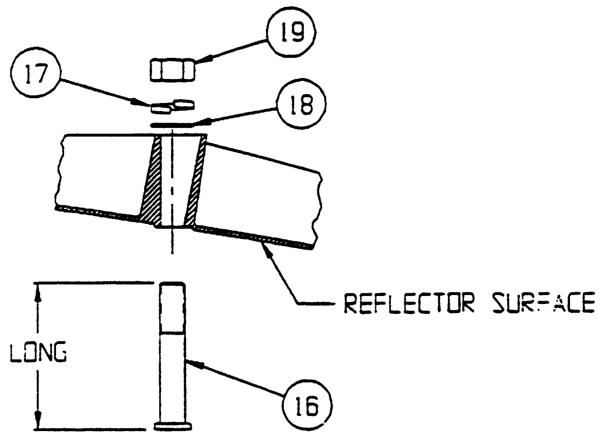
WARNING! The reflector support frame and the petals include precision alignment features. Do not drop or drag these pieces during the installation process. Do not attempt to adjust the square tube spacers in the frame assembly, as these are factory pre-set. If these spacers are loose or damaged, or there is any obvious damage to the frame or petals, you must obtain replacement parts for a successful installation.

Step 1: Remove the 1" dia. bolt from the elevation axis, and place the support frame (2) on the positioner, as shown in figure 2.2-1. Note the location of the elevation rod tab towards the top of the antenna. Replace the 1" bolt and tighten the nut enough to be snug, but allowing for rotation of the frame on the elevation axis. Let the frame lay down on the positioner.

Step 2: Identify the major and minor axis template assemblies; The major axis template (3) has four short angle stiffeners along the back with splice plates across the center, and two holes through the templates at the lower end. The minor axis template (4) has two long angle stiffeners along the length of the back. Place the minor axis template on the frame crosswise as shown, and secure with the 5/16 x 1.00" bolt, two flatwashers, lockwasher and nut (6,10,13,9) four places. Do not tighten this hardware yet.

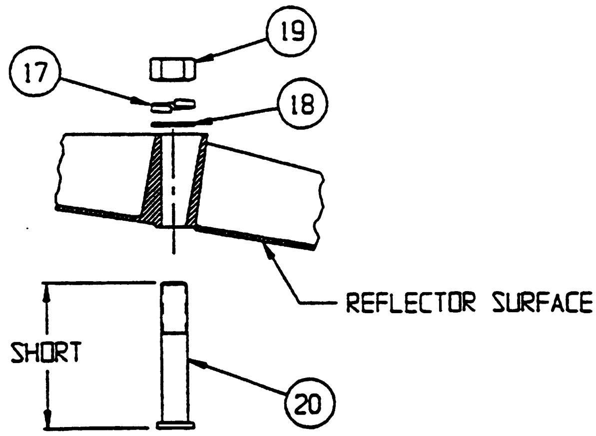
Step 3: Remove the hardware in one end of each of the splice plates on the major axis templates. Swing the splice plates out of the way, and place the major axis template over the minor axis template and onto the frame, noting the location of the two holes towards the bottom of the antenna. Attach with 5/16 hardware as above (6,10,13,9) at the lower mounting angle, and with 5/16 x .75" bolts, lockwashers and flatwashers (6,13,10) into the tapped holes at the upper location. Do not tighten hardware at this time. Swing the splice plates back underneath the minor axis template and replace the hardware.

Step 4: Locate quadrant #1 and notice the hole through the surface at the boss. Insert threaded spacer (#16) through the surface and attach at the back with a lockwasher (17), flatwasher (18) and hex nut (19). See below. Snug hardware only. Allow freedom of movement for backstructure assembly. NOTE: **THERE ARE DIFFERENT LENGTHS FOR THE TOP APERTURE AND BOTTOM. THE LONGER SPACERS MUST GO THROUGH THE TOP 2 QUADRANTS (QUAD 1 & QUAD 4) AND THE SHORTER ONES THROUGH THE BOTTOM 2 QUADRANTS (QUAD 2 & 3). PAY SPECIAL ATTENTION TO THE CORRESPONDING PART NUMBER OF EACH SPACER. A NUMBER HAS BEEN STAMPED ON THE HEAD AND SHOULD BE VERIFIED WITH TABLE 2.2-1.**
Locate quadrant #4 and insert threaded spacer (16) through the surface and attach in same manner as above.



QUADRANTS 1 & 4

Step 5: Locate quadrant #2 and insert threaded spacer (#20) through the surface and attach at the back with a flatwasher (18), lockwasher (17) and hex nut. See below. Snug hardware only. **NOTE: AGAIN VERIFY THAT THE SHORTER SPACER IS BEING USED HERE.**
Locate quadrant #3 and repeat above procedure. Verify that remaining hardware is the short spacer.



QUADRANTS 2 & 3

Step 6: Lift reflector quadrant #1 into position and place the flanges between the two templates on the major and minor axes. **Note that the longer side of the petal should be on the major axis.** Place a 5/16 x 1.5" bolt and flatwasher through the innermost hole, but only through the reflector flange and one template. This will hold the quadrant in place until the mating quadrant is positioned. The reflector insert should now be resting in the support frame. Refer to figure 2.2-1.

Step 7: Set quadrant #4 in position as shown, placing the petal flanges between the templates. Place a 5/16 x 1.5" bolt and flatwasher (7,10) through the innermost hole in the major axis template, through the petals, and through the other blade of the template. These bolts are designed to be a close fit. Adjust the petal as necessary to line up the holes. A wrench may be needed to "thread" the bolt through the petals. Secure with a flatwasher, lockwasher, and nut (10,13,9). Repeat this process, working out from the center, until all 4 bolts through the template have been installed. Secure the outer two flange joints with a bolt, flatwashers, lockwasher, and nut (7,10,13,9) 2 places. Snug hardware only to allow for the reflector to be attached to the support frame.

Step 8: Repeat the above procedure with quadrant #3. Connect the flanges and minor axis template between quad 3 and 4 as in Step 4.

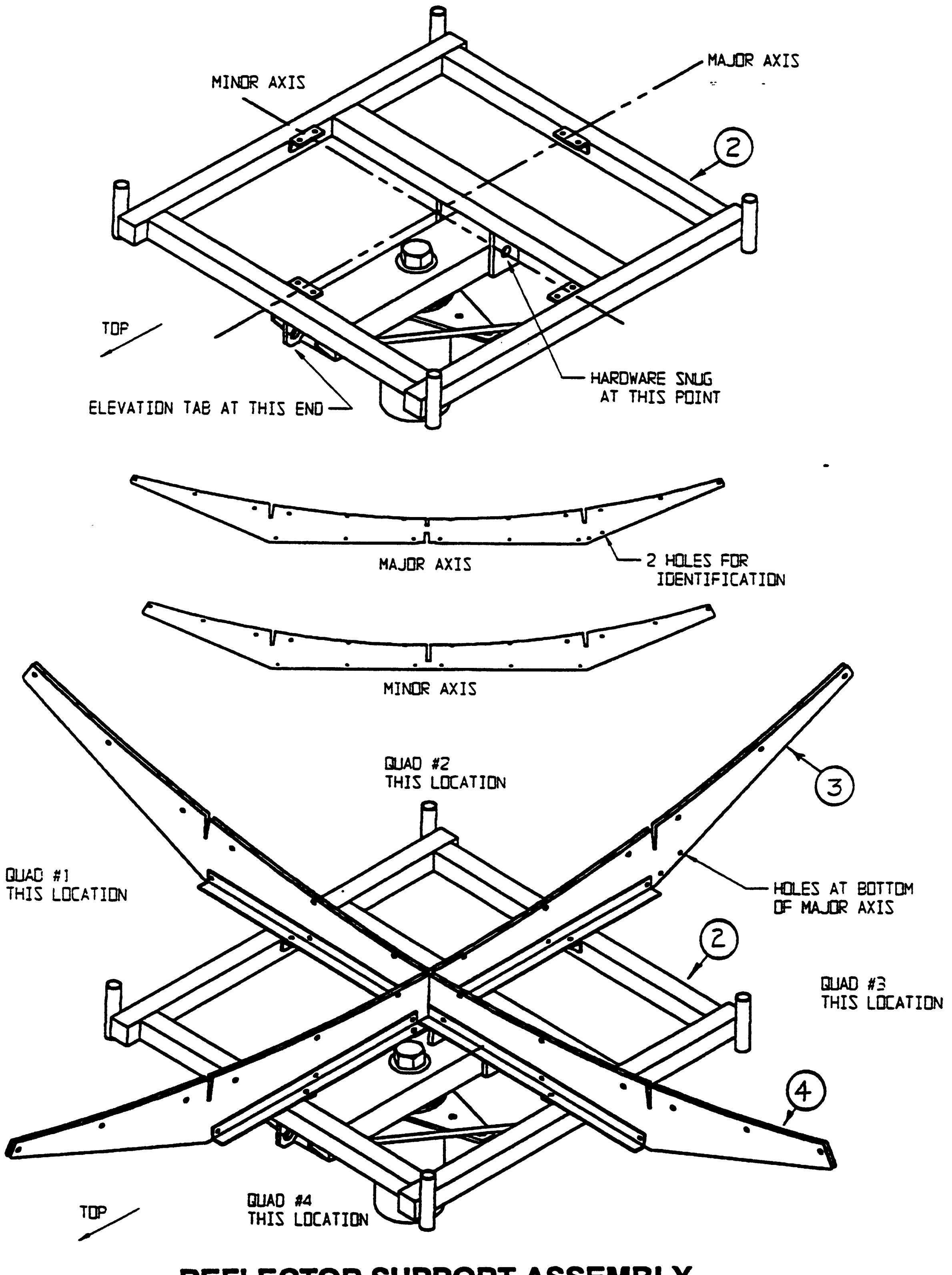
Step 9: Repeat the above steps with quadrant #2. Attach to both major and minor axes of quads 3 and 1.

Step 10: Place a **green** 1/2" washer (12) between the square tube of the frame and the insert in the reflector, and secure the petal with a 1/2" x 6.5" bolt, lockwasher, and standard 1/2" flatwasher (8,14,11). Repeat the above procedure with each quadrant and secure with a long 1/2" bolt (8), again placing a **green** washer (12) between the reflector petal and the frame and using 1/2" lockwasher and standard flatwasher (14,11). Once proper thread seating has occured, tighten 7/8 nut at the reflector spacer. Tighten until lockwasher is flat. Over tightening will damage boss. See figure 2.2-2 details.

Step 11: When all bolts are in place, tighten all reflector petal hardware, starting with the inner most bolts and working out. Tighten the hardware holding the template assemblies to the frame, and the long 1/2" bolts holding the petals to the frame.

Step 12: Remove the elevation block from between the ears of the positioner. Remove one 1" nut and flatwasher from the elevation rod. Run the other nut and flatwasher up the rod. Place the elevation adjustment block onto the rod, and replace the 1" washer and nut.

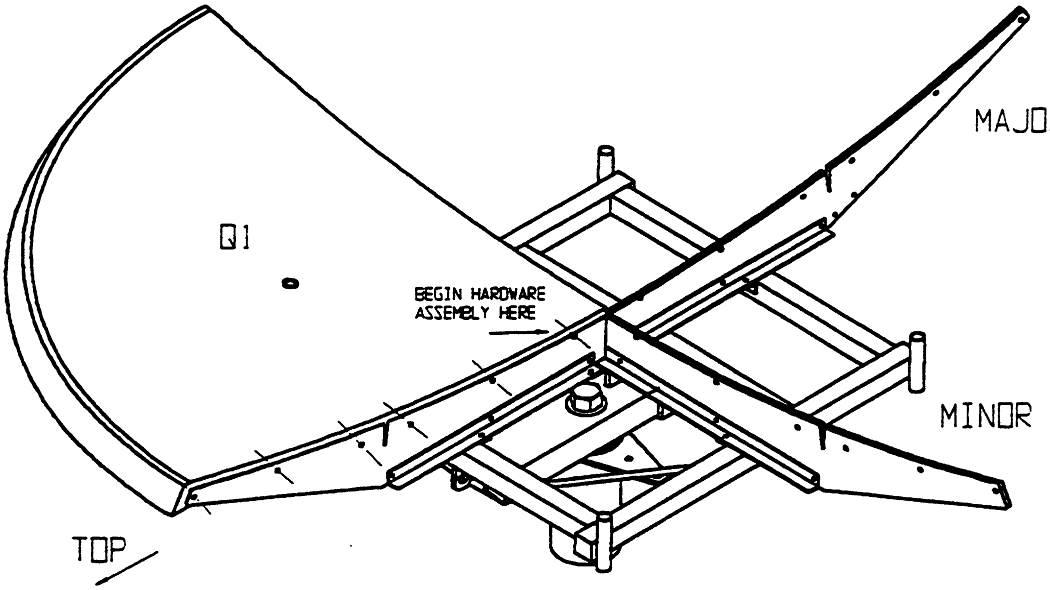
Step 13: Raise the antenna in elevation until the block can be replaced between the ears of the positioner. Adjust the antenna to a convenient elevation angle for feed support installation.

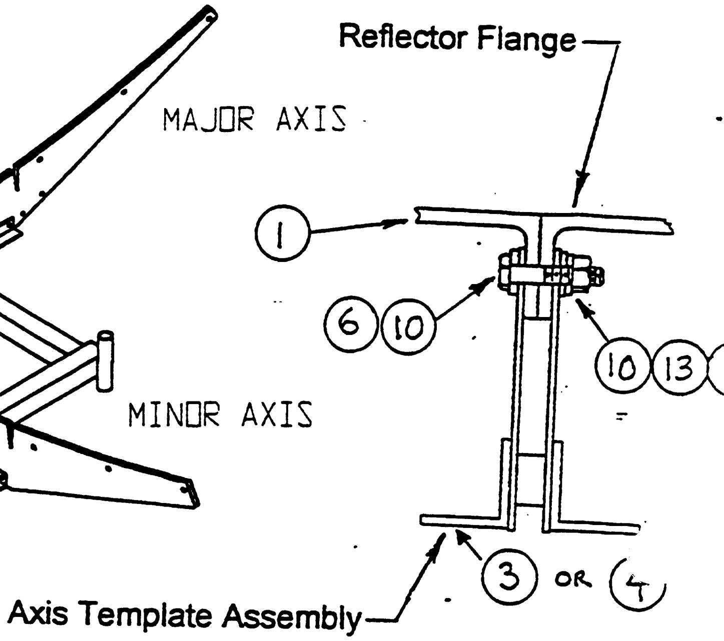


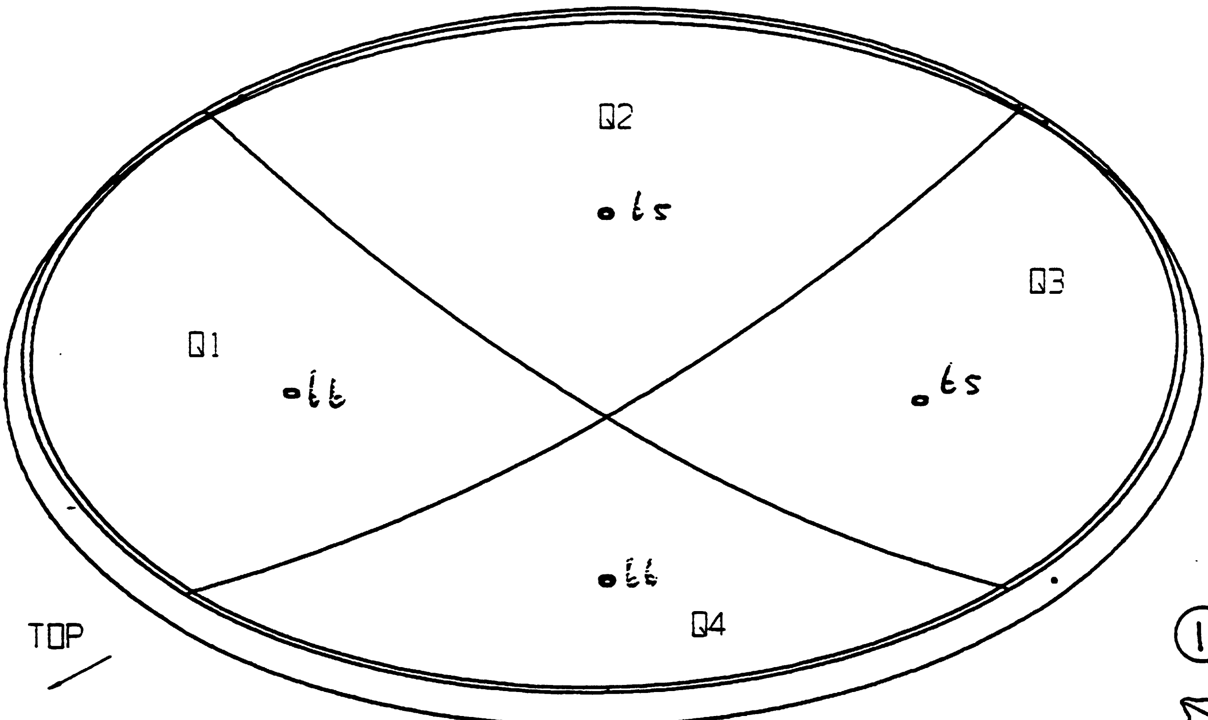
REFLECTOR SUPPORT ASSEMBLY
FIGURE 2.2-1

PARTS LIST
TABLE 2.2-1
(REFERENCE FIGURES 2.2-1, -2, -3)

ITEM#	PART#	DESCRIPTION	QTY
1	VARIOUS	2.4M REFLECTOR PETALS	4
2	0181-683	REFLECTOR SUPPORT FRAME	1
3	0181-692	MAJOR AXIS TEMPLATE ASSEMBLY	1
4	0181-693	MINOR AXIS TEMPLATE ASSEMBLY	1
5	0181-249	ELEVATION ROD ASSEMBLY	1
6	8031-008	5/16-18 X 1.0" BOLT	6
7	8031-012	5/16-18 X 1.5" BOLT	24
8	8033-052	1/2-13 X 6.5" BOLT	4
9	8101-009	5/16-18 HEX NUT	30
10	8201-041	5/16" FLATWASHER	62
11	8201-043	1/2" FLATWASHER, STANDARD	4
12	8201-033G	1/2" WIDE FLATWASHER, GREEN	4
13	8202-041	5/16" LOCKWASHER	32
14	8202-043	1/2" LOCKWASHER	4
15	8031-006	5/16 - 18 x .75" BOLT	2
16	0159-266	REFLECTOR SPACER, 4.863" LONG	2
17	8202-052	7/8" LOCKWASHER	4
18	8201-052	7/8" FLATWASHER	4
19	8110-007	7/8" HEX NUT	4
20	0159-265	REFLECTOR SPACER, 4.527" LONG	2


Q1
BEGIN HARDWARE
ASSEMBLY HERE
MAJOR AXIS
MINOR AXIS
TOP


Reflector Flange
1
6 10
10 13
3 OR 4
Axis Template Assembly


Q2
Q1
Q3
Q4
TOP

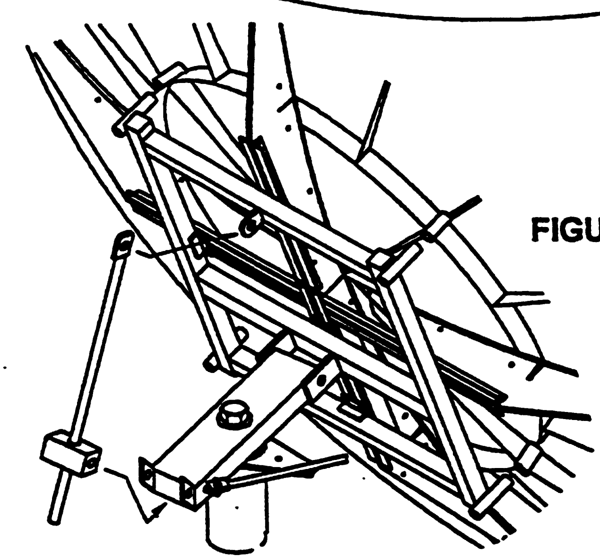
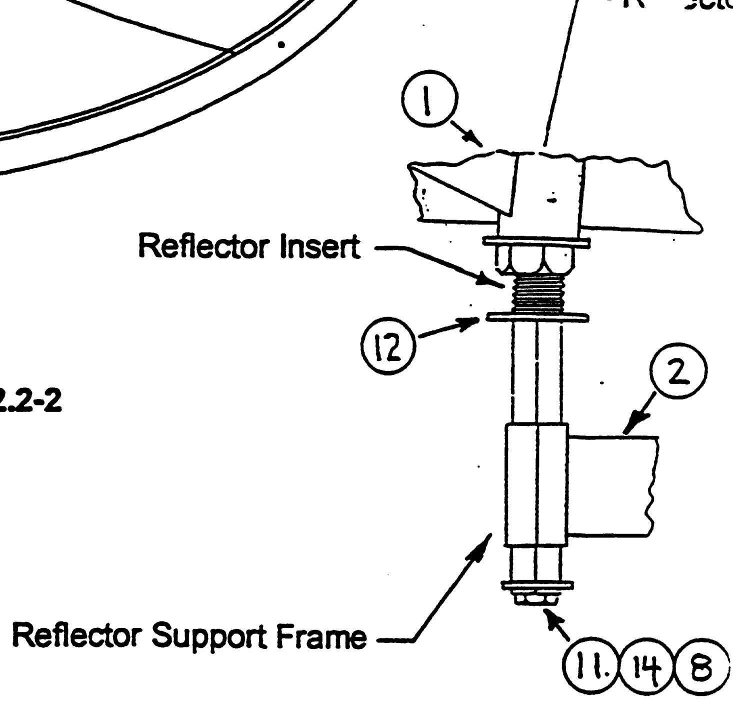


FIGURE 2.2-2


1
Reflector Insert
12
2
Reflector Support Frame
11. 14 8

2.3 FEED SUPPORT AND FEED STABILIZATION INSTALLATION

The following instructions cover the installation of a typical 2.4 meter feed system and feed stabilization kit onto the Prodelin 4 pc 2.4m antenna. For details concerning the specific feed and ODU installation, refer to the instructions packed with the feed system. Refer to Figure 2.3-1 and the parts list for this section and follow the instructions in the listed sequence.

STEP 1: Lower the reflector to it's lowest look angle. Attach the small end of each feed rod to the feed support tube with the 5/16-18 x 3.25" bolt, flatwashers, lockwasher, and nut (13,14,15,16). See detail "A". Do not tighten. Attach one feed rod to each side of the reflector with the 5/16-18 x 1.50" bolt, flatwashers, lockwasher, and nut (11,14,15,16) as shown in detail "B". Do not tighten.

STEP 2: Place a 1/2" (19) flatwasher onto each stud of the pivot collar (10) and assemble between the two feed stabilization brackets (6) with a 1/2" flatwasher, lockwasher and nut (19,29,18), as shown in detail C.

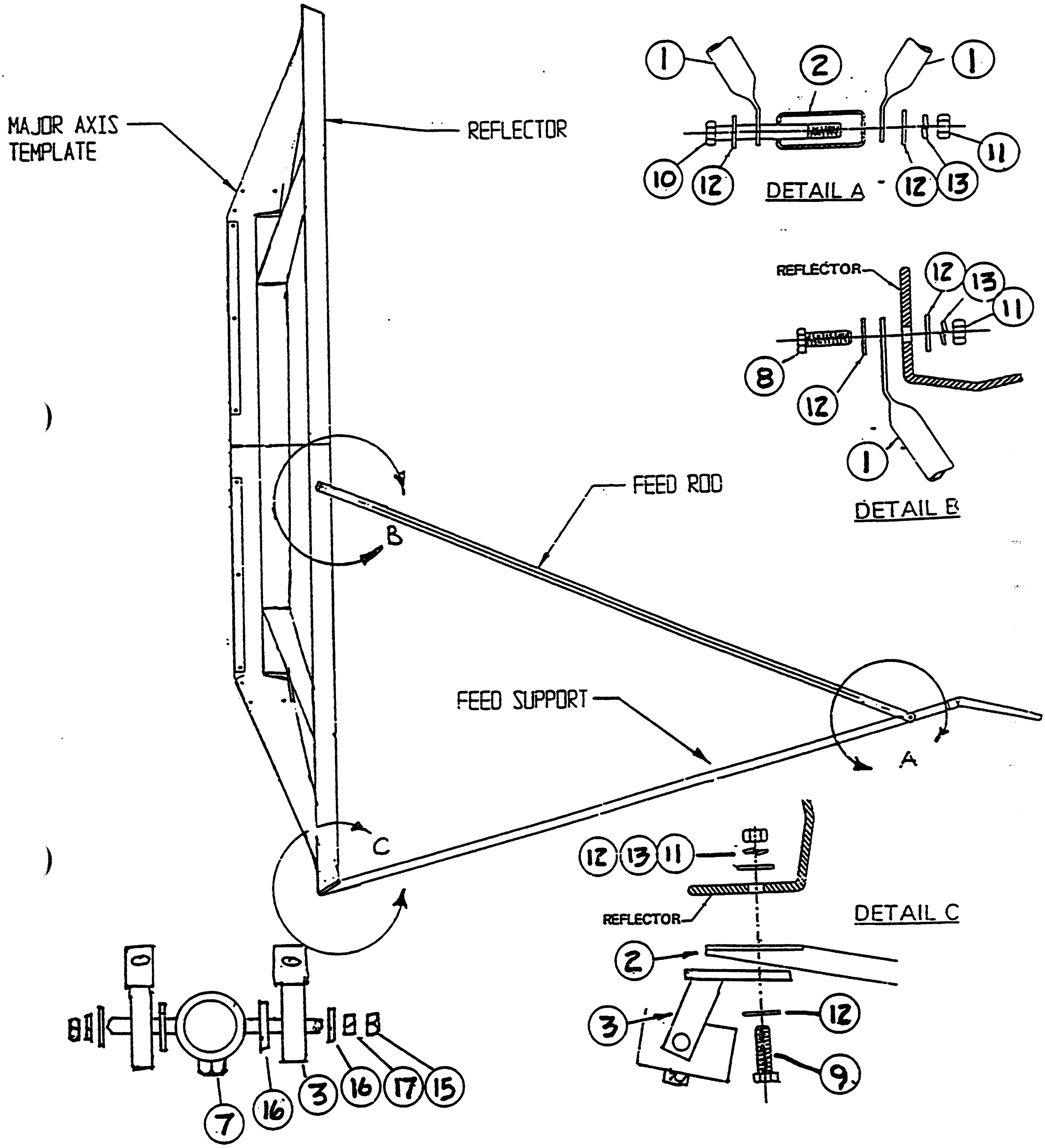
STEP 3: Mount the feed support to the bottom of the reflector, also attaching the feed stabilization brackets and pivot assembly with the 5/16-18 x 2.50" bolts, (4) flatwashers, (2) lockwashers, and (2) hex nuts (12,14,15,16). See detail "C". Tighten all feed support hardware at this time.

STEP 4: Bolt the two pipe collars around the mast pipe with the 5/16-18 x 2.50" bolts, flatwasher, lockwashers, and nuts (12,14,15,16), leaving all hardware loose. Note that the two tabs on the front collar go towards the reflector. Refer to figure 2.3-2.

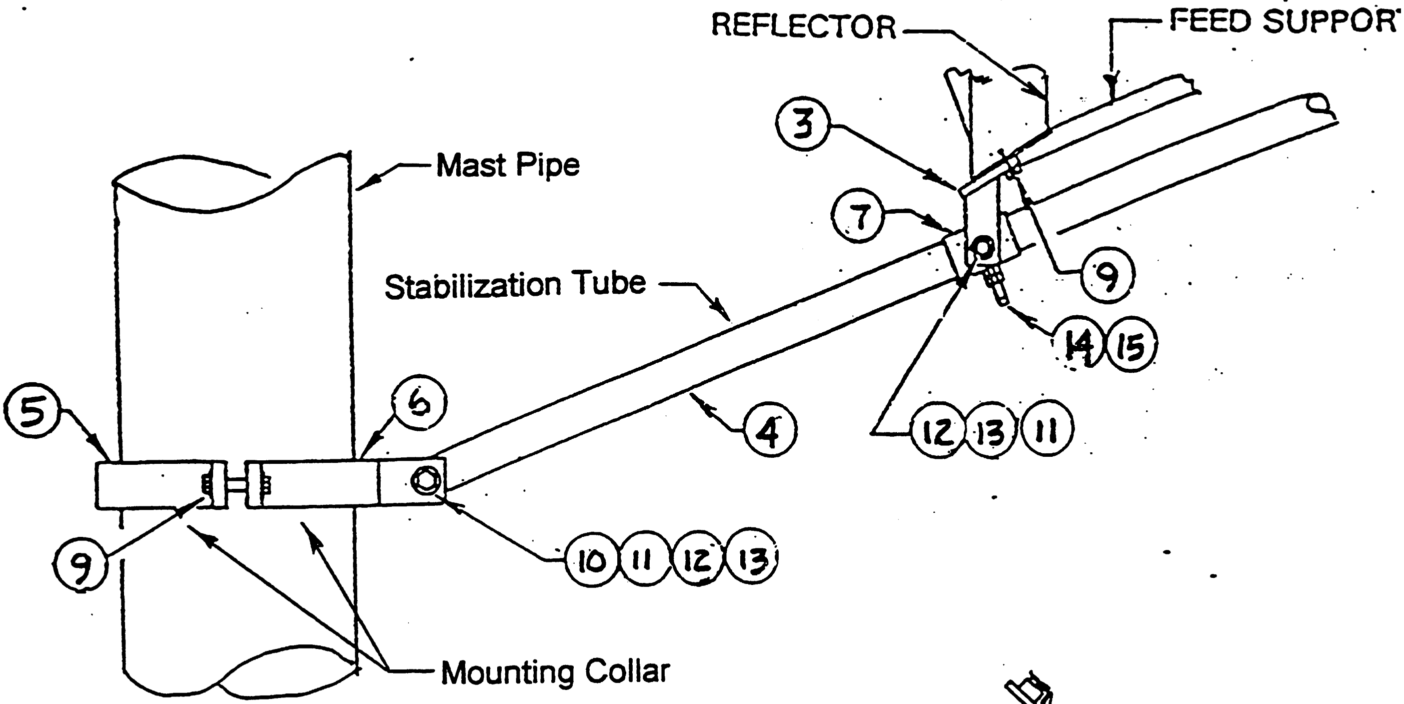
STEP 5: Slide the feed stabilization tube through pivot collar, drilled end first, and attach between the tabs on the pipe collar with the 5/16-18 x 3.25" bolt, flatwashers, lockwasher and nut (13,14, 15, 16). Do not tighten hardware. Install the 1/2-1 x 1.50" sq. hd. set screw with 1/2"nut on it into the pivot collar. After antenna pointing and alignment, all feed stabilization hardware should be fully tightened. The feed stabilization tube can be held parallel to the feed support arm by adjusting the pipe collars up or down on the mast pipe.

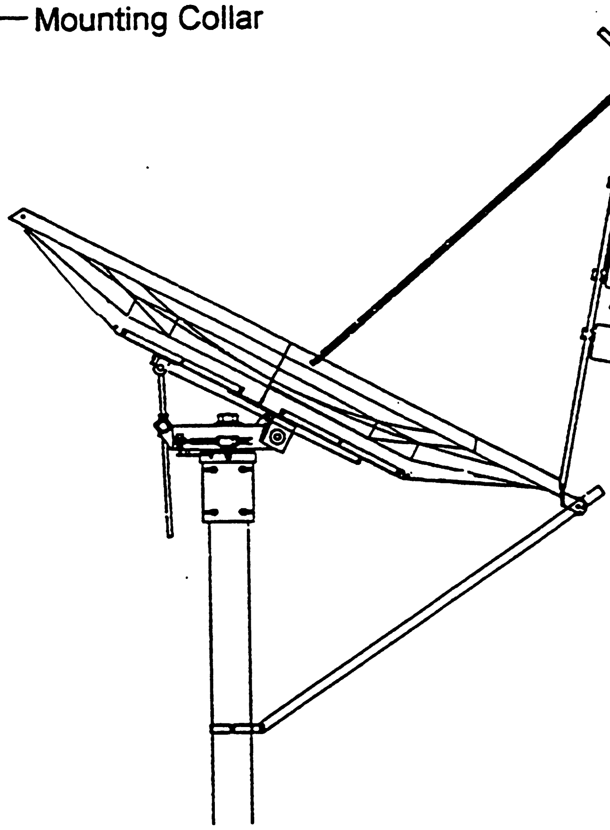
FEED SUPPORT/FEED STABILIZATION PARTS LIST

ITEM #	PART #	DESCRIPTION	QTY
1	VARIES	FEED ROD	2
2	VARIES	FEED SUPPORT ARM	1
3	0490-489	BRACKET, FEED STABILIZATION	2
4	0250-469	ROD, FEED STABILIZATION	1
5	0188-113	PIPE COLLAR, REAR	1
6	0490-393	PIPE COLLAR, FRONT	1
7	0490-368	PIVOT COLLAR	1
8	8031-012	5/16-18 X 1.50" BOLT	4
9	8031-020	5/16-18 X 2.50" BOLT	2
10	8031-026	BOLT, 5/16-18 x 3.25"	2
11	8101-009	NUT, 5/16-18	8
12	8201-041	FLATWASHER, 5/16"	14
13	8202-041	LOCKWASHER, 5/16"	8
14	8317-002	1/2" SQ HD CUP POINT SCREW	2
15	8104-007	NUT, 1/2-13	3
16	8201-043	FLATWASHER, 1/2"	4
17	8202-043	LOCKWASHER, 1/2"	2



FEED SUPPORT INSTALLATION
FIGURE 2.3-1





FEED STABILIZATION INSTALLATION
FIGURE 2.3-2

SECTION III ANTENNA POINTING

3.0 ALIGNMENT TO SATELLITE

The 4 pc 2.4 meter offset reflector contains a 17.35 elevation offset look angle. Therefore, when the reflector aperture is perpendicular to the ground, the antenna is actually looking 17.35 in elevation.

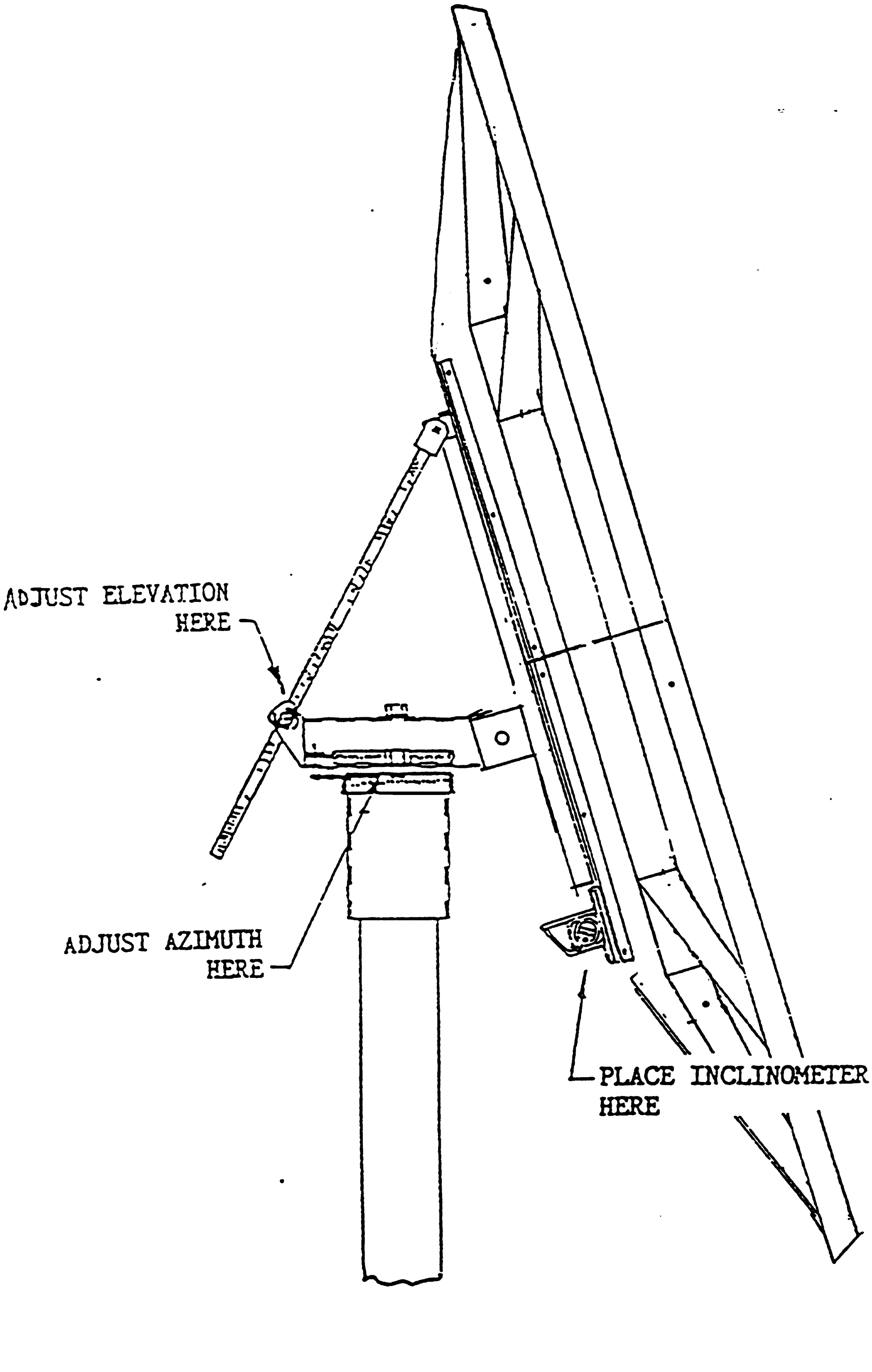
Step 1: Place an inclinometer on the back reflector ring to read the initial rough elevation as shown in figure 3.0-1. Note that the look angle of the reflector is the reading on the inclinometer plus 17.35 .

Step 2: Raise or lower the antenna to find the desired elevation by turning the 1" nuts located at the elevation block. Position the top nut so that it will not interfere with adjustment. Turn the bottom nut clockwise to increase elevation and counterclockwise to decrease elevation.

Step 3: After the correct elevation angle is set, rotate the antenna in azimuth by turning the 1" nuts located at the azimuth adjustment tube. Turn the front (near reflector) nut to decrease azimuth angle and the back nut to increase azimuth angle. Rotate azimuth until a signal is reached.

Step 4: Peak the antenna signal by fine adjustments made in both azimuth and elevation.

Step 5: Tighten the four 1" nuts used for adjustments.



ANTENNA POINTING
FIGURE 3.0-1

SECTION IV MAINTENANCE

4.0 MAINTENANCE OVERVIEW

After installation, the antenna requires only periodic inspection. It is anticipated that maintenance, if required, will be minimal and easily handled by a local or in-house maintenance staff. The materials used in the construction of this Earth Station Antenna virtually eliminate any maintenance repairs.

4.1 PERIODIC INSPECTION

It is suggested that a periodic inspection be performed at least every six months.

NOTE: After any severe weather conditions, inspection of the antenna should be performed to determine if foreign objects have caused damage or if survival specifications have been exceeded.

This inspection should include the following:

STEP 1: Check all bolting locations - all bolts should be tight.

STEP 2: Check all structural members - repair or replace if damaged.

STEP 3: Check the foundation anchor bolts - they must be secure and show no failure signs in foundation.

STEP 4: Check for corrosion - on the reflector structure and the mount.

4.2 REFLECTOR

Prodelin's reflector does not require any maintenance. The composite construction of the reflector is virtually impervious to any damages that could be caused by weather or atmospheric conditions.

It is only necessary to inspect for any physical damage done by vandalism or very severe weather conditions.

Should any damage be detected to a portion of the reflector, contact the Customer Service Department at Prodelin for recommendations involving reflector repair.

4.3 MOUNT AND REFLECTOR SUPPORT STRUCTURE

The mount and reflector support structure supplied with this antenna is of steel construction and has a hot-dip galvanized finish.

If inspection shows any signs of structural failure, the mount members that are damaged should be repaired or replaced.

CORROSION: Any corrosion on steel members may be repaired with a cold, zinc-rich galvanizing paint.

4.4 FEED AND FEED SUPPORT

The feed support should be inspected to insure that all hardware is secure. The feed/radio mounting bolts should be tight.

The feed horn window should be inspected to insure that it is intact so that no moisture can collect inside the feed horn. Replace if damaged.

1 GENERAL

The SSE Technologies SI 214 is a self contained RF Transceiver designed for a twoway satellite communications system that operates in the Ku-Band frequency range. The Transceiver transmits between 14.0-14.5 GHz and receives between 10.95 and 12.75 GHz depending on the satellite format selected. The following table provides a listing of available frequency bands.

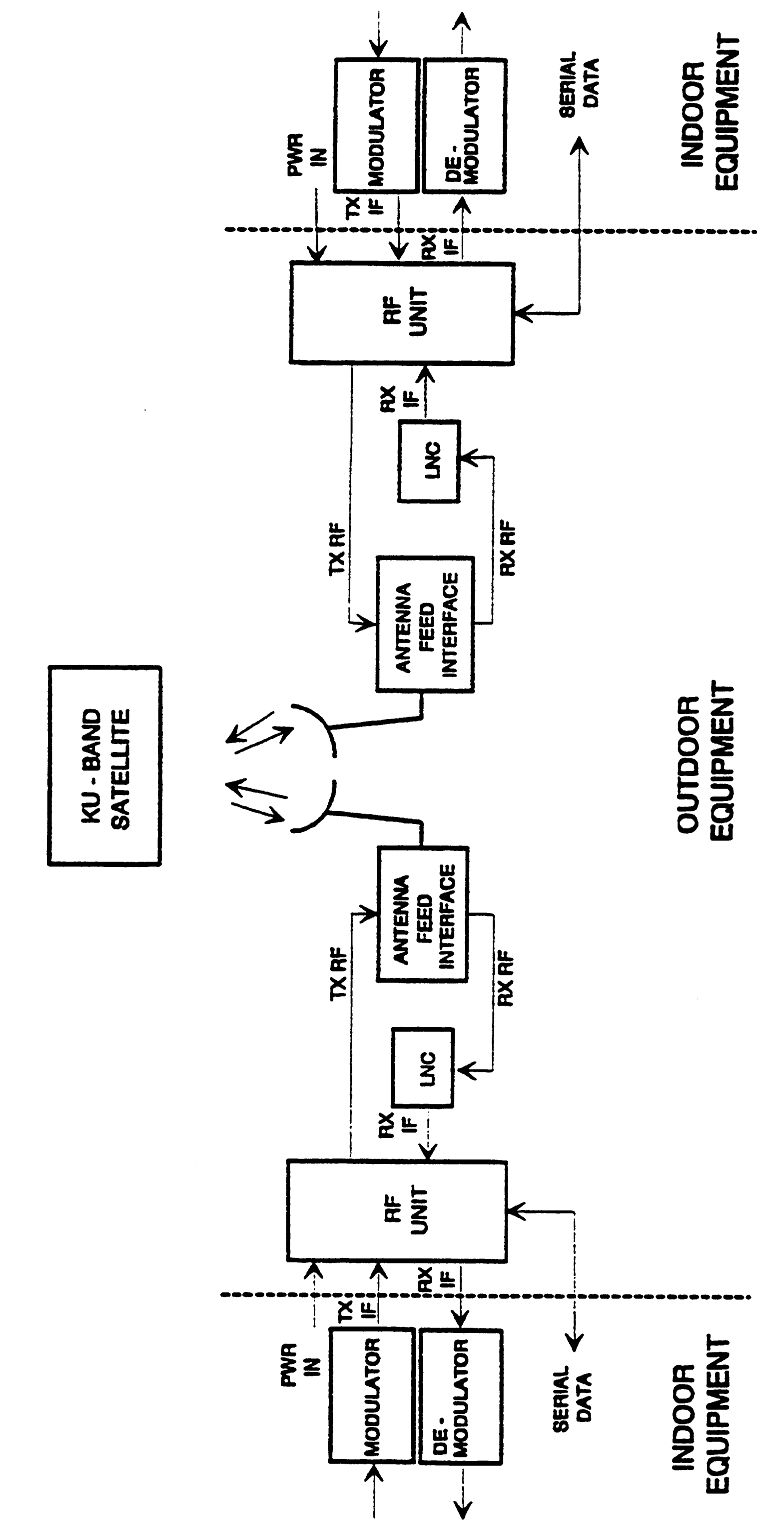
Frequency Band	Transmit Frequency (Mhz)	Receive Frequency(MHz)
INTELSAT LB	14000-14250	10950-11200
INTELSAT HB	14250-14500	11450-11700
ORION (Eu, Tr 1-8)	14250-14500	11450-11700
PANAMSAT	14000-14500	11450-11950
NORAM	14000-14500	11700-12200
ORION (N. Am)	14000-14500	11700-12200
AUSSAT	14000-14500	12250-12750
EUTELSAT	14000-14250	12500-12750
ORION (Eu, Tr 9-17)	14000-14250	12500-12750
WIDEBAND	14000-14500	10950-12750

The S1214 Transceiver is designed to interface with any 70 MHz or 140 MHz modem having a data capability of 9.6 kbps or higher and any size antenna.

Orion uses only 70 MHz modems.

It is used in a wide range of telephony and data distribution and collection applications, including: financial data transfer, oil well and pipeline monitoring; point-of-sales systems, electronic funds transfer; electronic mail, telephony voice store-and-forward communications and video conferencing. It can also be used for television satellite news gathering (SNG).

The function of the S1214 RF Transceiver is to upconvert the modulator's IFoutput to an RF signal for transmission via an antenna and to downconvert the received RF signal to an IF signal for use by the demodulator.



NOTES:
1. TX RF MAY BE 14.000 to 14.500 GHz.
2. RX RF MAY BE 10.950 to 12.750 GHz.
3. SERIAL DATA MAY BE RS232 or RS485.
4. IF MAY BE 70 ±20 MHz or 140 ±40 MHz.

FIGURE 1.1 TYPICAL ASAT S1214 RF TERMINAL APPLICATION DIAGRAM

1.3 FUNCTIONAL OPERATION

1.3.1 RF Transceiver (Refer to Figure 1.2)

The RFU upconverts a 70 or 140 MHz IF signal from a modulator to an RF frequency in the 14.0-14.5 GHz satellite band. The transmitter may be configured as a gain block (fixed gain), or optionally as an automatic level control (ALC) or automatic gain control (AGC) unit.

On the receive side, the LNC (Section 3.0) downconverts the satellite downlink band to a 70 MHz or 140 MHz signal, which is then fed to the RFU. The downconversion module includes a 14 GHz transmit reject filter and a low-noise downconverter.

1.3.2 Upconversion

The IF transmit signal enters the RFU at a frequency of 70 MHz ±20 MHz or 140 MHz ±40 MHz. In the first upconverter, the IF signal mixes with an LO signal to produce an L-Band signal. After passing through a bandpass filter, the signal is mixed in the second upconverter with a 12.71 GHz to 13.36 GHz frequency agile LO signal resulting in the desired RF frequency in the 14.0 GHz to 14.5 GHz band.

The RF signal is then amplified by the power amplifier. Active bias regulators in the power amplifier ensure that each stage of amplification is performed at the optimum operating point regardless of environment. The RF amplifier specified output power is at the 1 dB gain compression point.

1.3.3 Downconversion

The incoming receive RF signal passes through a transmit reject filter. The filtered signal then enters the low-noise downconverter that contains a low noise amplifier, filters and two or three downconversion stages depending upon the model. The first downconverter mixes the receive RF signal with the frequency agile LO signal in the frequency range between 12.71 GHz and 13.36 GHz. The first IF signal is then filtered and mixed in the second downconverter with a 1150 MHz, 750 MHz, 700 MHz, 600 MHz, 500 MHz or 350 MHz LO depending on the model. If a third downconverter stage is used, the IF is then mixed with an additional LO. The final result is an IF signal of 70 ±20 MHz or 140 MHz ±40 MHz. The IF signal is amplified and filtered before transmission to the demodulator.

1.3.4 LO Synthesizers

The LO signals that are mixed with the transmit and receive signals are derived by fixed and agile frequency synthesizers. The synthesizers are referenced to a 10 MHz oven stabilized crystal oscillator, specified for very low phase noise and high stability. Some units may be configured for an external 10 MHz source. The 10 MHz is routed to the fixed frequency synthesizer (FFL) to generate a 1.15 GHz LO. It is also routes to an agile synthesizer (FAL). The output of the agile synthesizer is then routed to the X4 multiplier where it is multiplied and amplified.

The frequency produced by the agile synthesizer is settable by the customer through DIP switches. An optional Monitor and Control (M&C) unit also may be used to set the frequency. The synthesizer provides selection of transmit and receive frequencies in 1 MHz steps over the 500 MHz band.

A fine adjustment is available on the 10 MHz crystal reference oscillator. This allows the correction of long term aging of the reference.

1.3.5 Summary Alarm Board

The S1214 functions are monitored by alarm circuitry that activates light emitting diodes (LEDs) on the summary alarm board. The alarms allow detection of power failure, LO failure, receiver failure and/or transmitter failure. Form A relays provide transmit or receive remote monitoring.

Figures 2.3 of Section 2.0 provides the summary alarm conditions and troubleshooting guidelines.

1.3.6 Power Supply

The power supply transforms -48 VDC, 115 VAC or 230 VAC line voltage to DC levels.

Regulators in the power supply unit produce the following DC voltages: +15 V, +10V, +5V, -5V and +12V.

Power supplies are also available for operation with $\pm$24 or $\pm$28 volt DC input.

1.4 TYPICAL OPERATING PARAMETERS

NOTE: Specifications apply to all models unless otherwise noted. Operating parameters are subject to change without notice.

1.4.1 RECEIVER SECTION

RECEIVER - INTERFACE

RF INPUT FLANGE	WR -75
RF INPUT VSWR	1.25:1 Maximum
IF OUTPUT CONNECTOR	N-Type Female
IF OUTPUT IMPEDANCE	50 Ohm Nominal
IF OUTPUT VSWR	1.50:1 Maximum
IF MONITOR CONNECTOR	N-Type Female
IF MONITOR VSWR	2.00 : 1 Maximum
IF MONITOR IMPEDANCE	50 Ohm Nominal

1.4.2 RECEIVER - ELECTRICAL

RF INPUT FREQUENCY	
10.950 - 11.200 GHz	INTELSAT LB
11.450 - 11.700 GHz	INTELSAT HB/ORION (Eu, Tr 1-8)
11.450 - 11.950 GHz	PANAMSAT
11.700 - 12.200 GHz	NORAM/ORION (N. Am)
12.250 - 12.750 GHz	AUSSAT
12.500 - 12.750 GHz	EUTELSAT/ORION (Eu, Tr 9-17)

* *Non-standard frequency offset must be set in demodulator for single synthesizer units.*

IF OUTPUT FREQUENCY	
(70 MHz SYSTEM)	70.000 +/- 20 MHz
(140 MHz SYSTEM)	140.000 +/-40 MHz
IF BANDWIDTH	
(70 MHz SYSTEM)	40 MHz
(140 MHz SYSTEM)	80 MHz
IF FILTER REJECTION @ 25 MHz From Band Edge (70 MHz System)	20 dB Minimum
IF FILTER REJECTION @ 50 MHz From Band Edge (140 MHz System)	20 dB Minimum
SYSTEM NOISE FIGURE @ 25° C	
200K LNC	2.3 dB Maximum
160K LNC (Optional)	1.9 dB Maximum
110K LNC (Optional)	1.4 dB Maximum
GAIN	85 dB Minimum
GAIN FLATNESS (500 MHz) @ 25° C. Referenced to band center	+/- 3 dB Maximum
GAIN FLATNESS (40 or 80 MHz) @ 25° C	2 dB P - P Maximum
GAIN FLATNESS (4 MHz) @ 25° C	0 .5 dB P - P Maximum
GAIN VARIATION over temp (500 MHz) (reference to gain @ 25° C)	+/- 4.0 dB Maximum
1 dB COMPRESSION (P1dB) @ receive IF @ 25° C	+ 7 dBm Minimum
INTERMODS (2 Tones @ -89 dBm each 30 KHz apart)	-35 dBc Maximum
IMAGE REJECTION	>45 dB
MAXIMUM OPERATIONAL RF INPUT LEVEL	- 82 dBm
RECEIVER MONITOR LEVEL	20 dB below RX IF Output nom.

1. 4.3 RECEIVER - OPTIONAL OUTPUTS

RF PORT

RF OUTPUT FREQUENCY

10.950 - 11.200 GHz	INTELSAT LB
11.450 - 11.700 GHz	INTELSAT HB/ORION (Eu, Tr. 1-8)
11.450 - 11.950 GHz	PANAMSAT
11.700 - 12.200 GHz	NORAM/ORION (N. Am)
12.250 - 12.750 GHz	AUSSAT
12.500 - 12.750 GHz	EUTELSAT/ORION (Eu, Tr. 9-17)

* *Non-standard frequency offset must be set in demodulator for single synthesizer units.*

CONNECTOR	SMA Female
GAIN	20 dB Minimum
GAIN FLATNESS	4 dB P - P Maximum
IMPEDANCE	50 ohm Nominal
VSWR	2.5:1 Maximum

L-BAND PORT

FREQUENCY OUTPUT (based on the type of system)

SYSTEM TYPE	L-BAND PORT OUTPUT
INTELSAT LOW BAND (10.950-11.200 GHz)	950 to 1200 MHz
INTELSAT HIGH BAND/ORION (Eu, Tr 1-8) (11.450-11.700 GHz)	1450 to 1700 MHz
PANAMSAT (12.250-12.750 GHz)	Not available
NORAM/ORION (N. Am) (11.700-12.200 GHz)	950 to 1450 MHz
AUSSAT (12.250-12.750 GHz)	Not available
EUTELSAT/ORION (Eu, Tr 9-17) (12.500-12.750 GHz)	1025 to 1275 MHz

CONVERSION GAIN	50 dB Minimum
GAIN FLATNESS	6 dB Peak to Peak Maximum
FREQUENCY STABILITY (-40°C to +60°C)	+/- 2 MHz (+/- 20 KHz Optional)
VSWR	2.5:1 Nominal
IMPEDANCE	75 Ohm Nominal
CONNECTOR	"F" Type, Female
DC POWER thru "F" CONNECTOR)	+15 to +24 VDC, 175 mA

1.4.4 TRANSMITTER SECTION

TRANSMITTER - INTERFACE

IF INPUT CONNECTOR	N-Type Female
IF INPUT IMPEDANCE	50 Ohm Nominal
IF INPUT VSWR	1.50:1 Maximum
RF OUTPUT INTERFACE	WR-75
RF OUTPUT VSWR	2.0:1 Maximum

TRANSMITTER - ELECTRICAL

RF OUTPUT FREQUENCY

14.00-14.50 GHz	NORAM/AUSSAT/PANAMSAT/ ORION (N. Am) or
14.00-14.25 GHz	INTELSAT LB/EUTELSAT/ ORION (Eu, Tr 9-17) or
14.25-14.50 GHz	INTELSAT HB/ORION (Eu, Tr 1-8)

IF INPUT FREQUENCY	
(70 MHz SYSTEM)	70.000 +/- 20 MHz
(140 MHz SYSTEM)	140.00 +/-40 MHz
INPUT LEVEL (IF) for ALC	-30 dBm +/- 4 dB
INPUT LEVEL (IF) for fixed GAIN for P1dB	-30 dBm +/- 4 dB
BANDWIDTH IF to RF (70 MHz SYSTEM)	40 MHz
BANDWIDTH IF to RF (140 MHz SYSTEM)	80 MHz
SMALL GAIN SIGNAL @ 25 C.@ center frequency	
DRIVER ONLY	31 dB Nominal
2 WATT SSPA	63 dB Nominal
4 WATT SSPA	66 dB Nominal
8 WATT SSPA	69 dB Nominal
16 WATT SSPA	72 dB Nominal
20 WATT SSPA	73 dB Nominal
25 WATT SSPA	74 dB Nominal
GAIN FLATNESS (500 MHz) @ 25 C	4 dB P - P Maximum
GAIN FLATNESS (40 or 80 MHz) @ 25 C	2 dB P - P Maximum
GAIN FLATNESS (4 MHz) @ 25 C.	0 .5 dB P - P Maximum
GAIN VARIATION over temp. (500 MHz)	+/- 2.0 dB Maximum
REFERENCE to GAIN @ 25°C Power @1 dB Compression Point (P1dB) @ 25° C	
DRIVER ONLY	+8 dBm Minimum
2 WATT SSPA	+33 dBm Minimum
4 WATT SSPA	+36 dBm Minimum
8 WATT SSPA	+39 dBm Minimum
16 WATT SSPA	+42 dBm Minimum
20 WATT SSPA	+43 dBm Minimum
25 WATT SSPA	+44 dBm Minimum
INTERMODS	
SSPA - 2 Tones @ 30 KHz spacing composite 6 dB OBO	-33 dBc Maximum
SPURIOUS	
>10 KHz Offset	-20 dBm Maximum
<10 KHz Offset	-40 dBc Maximum
TRANSMITTER Shutdown Attenuation @ 25°C	25 dB Minimum @ rated power

1.4.5 LOCAL OSCILLATORS

FREQUENCY STABILITY per day	1 x 10 -9 Maximum
FREQUENCY STABILITY per year	5 x 10 -8 Maximum
TUNING STEP SIZE	1.0 MHz
PHASE NOISE @ 100 Hz	-60 dBc/Hz Maximum
@ 1 KHz	-70 dBc/Hz Maximum
@ 10 KHz	-75 dBc/Hz Maximum
	-80 dBc/Hz Maximum (optional)
@ 100 KHz	-85 dBc/Hz Maximum
	-90 dBc/Hz Maximum (optional)
@ 1 MHz	-90 dBc/Hz Maximum

1.4.6 ALARM INDICATORS

+ 5 VDC (LOSS OF VOLTAGE)	Alarm on Loss of voltage
+10 VDC (LOSS OF VOLTAGE)	Alarm on Loss of voltage
+15 VDC (LOSS OF VOLTAGE)	Alarm on Loss of voltage
-5 VDC (LOSS OF VOLTAGE)	Alarm on Loss of voltage
RX IF LEVEL	Alarm if RX gain drops below 65 dB

FFL LOCK (Fixed Frequency Loop 1 GHz LO)	Alarm on loss of FFL Lock (Disables transmit)
SYNTH #1 LOCK (SYNTHESIZER)	Alarm on loss of FAL Lock (Disables transmit)
SYNTH #2 LOCK (SYNTHESIZER)	Alarm on loss of FAL Lock
TX POWER	Alarm if TX gain drops 20 dB below rated power.
SUMMARY STATUS	Alarm On if any other alarm is On
TRANSMIT ALARM OUTPUT (Closed Contact)	J4 Pin A to B
RECEIVE ALARM OUTPUT (Closed Contact)	J4 Pin C to B
TRANSMITTER SHUTDOWN	J4 Pin D to Ground
TRANSMITTER DISABLE (Power Up)	~ 5 Minutes Time Delay

1.4.6 POWER REQUIREMENTS

INPUT VOLTAGE	115 VAC +/-10% @ 50-60 Hz or 230 VAC +/-10% @ 50-60 Hz or -48 VDC +/- 12V

1.4.7 POWER CONSUMPTION

0 dBm/RXO	100 VA Typical
2 WATT	160 VA Typical
4 WATT	174 VA Typical
8 WATT	275 VA Typical
16 WATT	421 VA Typical
20/25 WATT	900 VA Typical

1.4.8 ENVIRONMENTAL

OPERATING TEMPERATURE	-30 to +60^{o} C (VDE Approved) -40 to +60^{o} C
ALTITUDE	14000 feet ASL Maximum
HUMIDITY (Condensing)	100% Relative Maximum

1.4.9 MECHANICAL SPECIFICATIONS

WEIGHT

LNC with TR Filter	.9 Kg (2 lbs) Maximum
2W and 4W RF Unit	16 Kg (36 lbs) Maximum*
8W RF Unit	17.3 Kg (39 lbs) Maximum*
16W RF Unit	18.7 Kg (42 lbs) Maximum*
20/25W RF Unit	20 Kg (45 lbs) Maximum*

*Weight shown includes M&C and Dual Synthesizer option

1.4.10 OVERALL DIMENSIONS

LNC with TR filter	35.6 x 3.8 x 6.4 cm (14.0 x 1.5 x 3.5 in.)
2W and 4W RF Unit	62.0 x 26.9 x 20.1 cm (24.4 x 10.6 x 7.9 in.)
8W - 25W RF Unit (Includes Fan Cable)	71.1 x 26.9 x 25.9 cm (28.0 x 10.6 x 10.2 in.)

1.4.11 SURFACE FINISH

Painted surfaces:	White per FED-STD-595A, SPEC NO. 604-27875, High solid polyurethane, textured
Unpainted surfaces:	Chem Film per MIL-C-5541 Class 3 or Black Anodized

1.5 INSTALLATION

1.5.1 General

The S1214 RF Transceiver consists of an RF unit, low noise converter (LNC) and interconnection cables.

This sub-section contains the general requirements for installation of the S1214 RF Transceiver on the antenna and to make cable and waveguide connections. Refer to the antenna manufacturers' instructions for more detailed guidelines.

WARNING:

- ***FOR PROTECTION OF PERSONNEL AND EQUIPMENT, USE PARTICULAR CARE INSTALLING THE ANTENNA AND WHENEVER WORKING ON OR AROUND THE SYSTEM.***
- ***TAKE STANDARD SAFETY PRECAUTIONS WITH HAND AND/OR POWER TOOLS.***
- ***USE CARE IN WORKING WITH DANGEROUS VOLTAGES.***

1.5.2 Site Considerations

The RF Transceiver is designed to mount onto any size antenna. Locate and install the antenna according to instructions supplied by the antenna manufacturer. Choose an area that is free of extraneous interference from motors and electrical equipment and has a clear line of sight from the antenna to the satellite. Lightning arrestors should be used at the site to protect personnel and equipment. Size 3/0 or 4/0 stranded copper wire should be used to ground the RFU and LNC to the antenna frame and to the lightning protection ground rod. Provide an isolation filter to clean up power line interference as required.

1.5.3 Unpacking

Check to make sure that the transceiver has not suffered any damage in shipment. If a shock watch monitor is installed on the unit, check to see if it is clear (good). A red shock watch indicates that the unit has been subjected to excessive shock during shipment or handling and should be noted on the freight company's receiving document.

Compare contents of the shipping container with the packing list to ensure all items have been received. Retain all shipping containers for future use.

1.5.4 Preparation

Mounting Considerations
An optional Installation Kit is available. The RF Transceiver must be mounted such that:

(1) Sufficient support is afforded the Transceiver to minimize the effects of antenna sway in strong winds.

SECTION 2.0 RF UNIT

TABLE of CONTENTS

2.1 GENERAL

The RFU is designed to operate with any SSE Technologies Ku Band RF Transceiver. The RF driver unit is available with either a 70 MHz or 140 MHz IF interface.

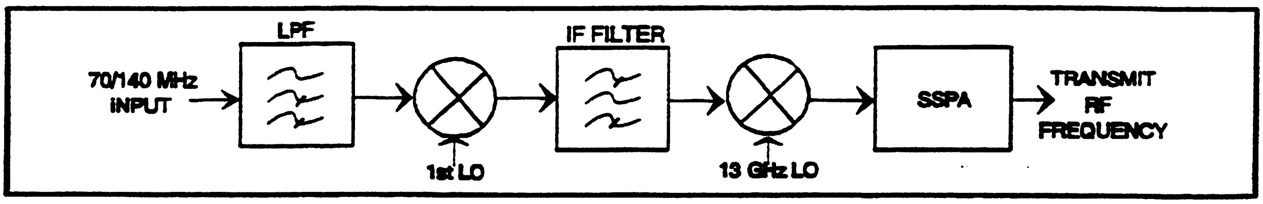
Frequency options are provided for INTELSAT, PanAmSat, Noram, Aussat (Optus) and Eutelsat operation. Figure 2.1 provides a transmit conversion chart and simplified block diagram of the upconversion process.

The RFU has four primary functions:

1. Provides the local oscillator for upconversion and downconversion.
2. Upconvert the IF signal from the modulator to a transmit RF signal.
3. Amplify the RF signal.
4. Process and display alarm signals.

2.2 FUNCTIONAL OPERATION

The RFU upconverts a 70 MHz or 140 MHz IF signal from a modulator to an RF frequency in the 14.0-14.5 GHz satellite band. The transmitter may be configured as a gain block (fixed gain), automatic level control (ALC), or automatic gain control (AGC). Figure 2.2 contain a functional block diagram of the RFU.



TRANSMIT CONVERSION CHART (70 MHz)

BAND	1st LO (MHz)	1st IF	2nd LO (MHz)	RF FREQ (MHz)
INTELSAT HB/	1150	1220	12780 - 13030	14000 - 14250
ORION (Eu 1-8)	1150	1220	13030 - 13280	14250 - 14500
PANAMSAT	1150	1220	13030 - 13280	14250 - 14500
NORAM/	1150	1220	12780 - 13280	14000 - 14500
ORION (N. Am)	1150	1220	12780 - 13280	14000 - 14500
AUSSAT	1150	1220	12780 - 13280	14000 - 14500
EUTELSAT/	1150	1220	12780 - 13280	14000 - 14500
ORION (Eu 9-17)	1150	1220	12780 - 13280	14000 - 14500

TRANSMIT CONVERSION CHART (140 MHz)

BAND	1st LO (MHz)	1st IF	2nd LO (MHz)	RF FREQ (MHz)
INTELSAT HB/	1150	1290	12710 - 12960	14000 - 14250
ORION (Eu 1-8)	1150	1290	12960 - 13210	14250 - 14500
PANAMSAT	1150	1290	12960 - 13280	14250 - 14500
NORAM/	1150	1290	12710 - 13210	14000 - 14500
ORION (N. Am)	1150	1290	12710 - 13210	14000 - 14500
AUSSAT	1150	1290	12710 - 13210	14000 - 14500
EUTELSAT/	750	1290	12710 - 13210	14000 - 14500
ORION (Eu 9-17)	750	1290	12710 - 13210	14000 - 14500

2.2.1 Upconversion

The IF transmit signal from the modulator enters the RFU through J1 at the frequency of 70 ±20 MHz or 140 MHz ±40 MHz. The signal is routed to the first upconverter where it is filtered, amplified and then mixed with the first LO (see Figure 2.1 for the actual frequencies). The output of the first upconverter is then routed to the IF filter module where unwanted frequencies from the first upconverter mixing process are filtered out.

The signal is then routed to the second upconverter where it is amplified, upconverted with the 13 GHz LO, filtered and again amplified prior to transmission to the SSPA.

2.2.2 Power Amplifier Functional Operation

The power amplifier unit functionally is situated at the output of the RF unit. The Solid State Power Amplifier (SSPA) provides signal amplification as a final step before transmission.

The SSPA receives a 14.00 to 14.50 GHz RF input from the 2nd upconverter unit. This input signal is fed through an isolator and then through several gain stages, the quantity of which is dependent upon the SSPA model. Each gain stage uses active biasing to ensure that it is performing at optimum level regardless of temperature. The SSPA amplifies the RF input signal to the level specified in following table.

Power Output Amplification (minimum)

Unit	Gain
2W	34 dB
4W	37 dB
8W	40 dB
16W	43 dB
20W	44 dB
25W	45 dB

Given the SSPA gain, the input RF drive level must be at no less than 0 dBm in order to achieve the rated output power level of the SSPA. The 2W unit output power level is +33 dBm, therefore, 33 dB gain @ P1 dB is required in the 2 watt SSPA. It should be noted that the 0 dBm RF input must be linear (not compressed) in order to achieve the proper system performance.

The SSPA has been designed for minimum distortion (third order) when multiple carriers are used.

2.2.3 Detector Operation

The RF output of the SSPA is sampled through the use of a coupler and detector. The detected level is then sent to the driver transmit control card for processing. The detected DC level will typically be at 2.5 VDC with little or no RF output of the

SSPA and greater than 3.2 VDC @ P1 dB depending on the model and power output of the SSPA.

2.2.4 Power Supply Functional Operation

The power supply for the S-Series transceiver is located within the RFU. AC power is applied through P1 on the RFU and is routed to an AC to DC converter module. The AC to DC module converts the input AC voltage to 300 VDC. The 300 VDC is then routed to a DC to DC converter module where it is converted to 12 VDC. The +12 VDC is then routed to the regulator circuit where +15 VDC, +10 VDC, +5 VDC and -5 VDC are generated. The multiple voltages are routed to a connector to power the various models. The +12 VDC output of the DC to DC converter is also routed to a connector to power the SSPA.

2.2.5 LO Synthesizers

The LO signals that are mixed with the transmit and receive signals are derived by fixed and agile frequency synthesis. The synthesizers are referenced to a 10 MHz oven stabilized crystal oscillator, specified for very low phase noise and high stability (options are available with input for external 10 MHz reference). An automatic transmitter inhibit circuit may control the transmitter during crystal oscillator warm up. The transmitter may be inhibited during the 5 minutes from cold turn on. This delay will allow the output frequency to be within 1 kHz of the selected frequency before the transmitter is enabled. The 10 MHz is routed to the fixed frequency synthesizer to generate a 1.150 GHz LO. It is also routed to an agile synthesizer for generation of a 3152.5 MHz to 3,340.0 MHz signal. The agile synthesizer feeds a X4 multiplier where the frequency is multiplied by a factor of 4.

The frequency produced by the agile synthesizer can be set by the customer through DIP switches. The frequency also can be fine adjusted through a screw on the crystal oscillator. The synthesizer provides selection of transmit and receive frequencies, in 1 MHz steps, over the 500 MHz band. The 10 MHz also may be routed to an additional LO source to generate a 350/500/600/700 or 750 MHz LO dependent upon the satellite downlink frequency band.

2.2.6 Summary Alarm Board

Driver functions are monitored by alarm circuitry that activates light-emitting diodes (LED's) on the summary alarm board (see Figure 2.3). These alarm indicators also may be fed to a monitor and control unit for further processing. The alarms allow detection of DC voltage failure, LO failure, receive failure and transmit failure. Form A relays are provided for transmit or receive remote monitoring. Also provided is a transmitter disable function.

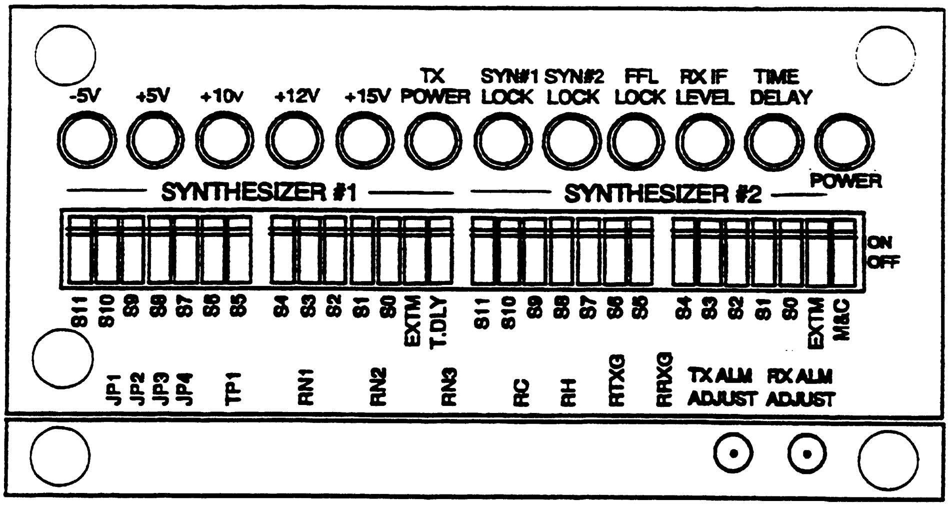


FIGURE 2.3 SUMMARY ALARM CONDITIONS/TROUBLESHOOTING

Alarm LED	Condition Indicated
-5 V	Absence of –5 V DC
+5V	Absence of +5 V DC
+10 V	Absence of +10 V DC
+12 V	Absence of +12 V DC
+15 V	Absence of +15 V DC
TX Power	Absence of transmit signal at 14 GHz (LED will light when there is no IF input).
Synth Lock No 1	Loss of lock in the frequency agile synthesizer or absence of FAL No 1.
Synth Lock No 2	Loss of lock in the optional second frequency agile synthesizer or absence of FAL No 2.
FFL Lock	Loss of lock on the fixed frequency synthesizer or absence of FFL assembly.
RX IF LEVEL	Loss of Receive IF output signal.
Time Dly	Red during transmit time delay (~5 minutes) Green after initial time delay.
Power	On when DC power is present.

2.2.7 Downconverter

The entire downconversion process occurs in the LNC The output of the LNC is then routed to the RFU through J7. This signal is split for the receive alarm indications and then routed to J2 for transmission to the demodulator.

2.4.3 Cable and Waveguide Connections

NOTE: Figure 1.3A and 1.3B (Section 1) shows a system level cabling diagram that can be used as a reference when making the following cable connections to the driver unit.

1. Attach one 50Ω coaxial cable to the RFU at the N connector labeled J1 TX IF INPUT and to the modulator at the appropriate BNC connector.
2. Attach a 50Ω coaxial cable to the driver at the N connector labeled J2 RF IF OUTPUT and to the demodulator at the appropriate BNC connector.
3. For receive frequency of 10.95-11.2 GHz, use an INTELSAT LNC and attach the 2nd LO cable between LNC connector J5 and RFU connector J9.** For receive frequency of 11.45 - 11.95 Hz, use a PANAMSAT LNC and attach the 2nd LO cable between LNC connector J3 and RFU connector J9.
4. Attach the HFLO RF cable between LNC connector J4 and RFU connector J8.
5. Attach the LNC DC cable between LNC connector J2 and RFU connector J6.
6. Attach the LNC IF cable between LNC connector J1 and RFU connector J7.
7. Connect a 3.0 AWG (American Wire Gauge) or equivalent wire ground lug to earth ground. Make sure that the connections are weather-tight.

** If the LNC is triple downconverter then LNC J3 is the 3rd LO port, otherwise, LNC J3 is the 2nd LO port and LNC J5 is not used.

2.4.4 Water Resistant Wrap

The application of moisture resistant wrap (mastic tape) to all connectors is recommended to prevent water entry and resultant water damage. Apply mastic tape as follows:

1. Ensure that all connectors are tight.
2. Precut the mastic tape to the desired size.
3. Center the tape on the connector to be seated and wrap the tape tightly. Squeeze the tape tightly to ensure both ends of the tape have formed around the connector and cable.
4. Apply the tape to all connectors that may be exposed to moisture.

2.4.5 Grounding

Electrical bonding (grounding) of the RFU and LNC units is recommended to prevent possible damage from lightning and/or other induced electrical surges.

The RFU is provided with grounding lugs. It is recommended that 000 AWG (American Wire Gauge) multiconductor copper wire be used to bond the RFU and LNC units together and to the earth ground (grounding rod), using the most direct (shortest) routes possible.

2.5 TROUBLESHOOTING

2.5.1 General

Prior to troubleshooting the RFU, the antenna should be set to the desired azimuth and elevation settings per manufacturer's instructions.

CAUTION: ***The transceiver must not transmit until alignment and any necessary adjustments are complete.***

Make sure that the TX IF INPUT (J1) is disconnected at the RFU to prevent accidental transmission interference with adjacent satellites or transponders before attempting to align the system or before performing any other operation involving the driver. Before attempting any system change, carefully evaluate the possible effects on the transmitted signal.

2.5.2 Summary Alarm Conditions and Troubleshooting

If you suspect trouble or failure of the driver, remove the Summary Alarm access lid to observe the summary alarm board. Light-emitting-diodes (LED's) on the summary alarm board will light in the presence of alarm conditions. Refer to Figure 2.3 for alarm conditions.

2.5.3 Test Equipment

The following test equipment or equivalent is recommended for installation, system alignment and troubleshooting:

Spectrum Analyzer	HP 8569A
Power Meter	HP 436A
Power Heads	HP 8481H, HP 8484A
Digital Voltmeter	Fluke 8050

Adapter WR-75 to coax (calibrated insertion loss @ 14-15 GHz)
Assortment of cables, connectors and adapters (calibrated @14-15 GHz)
Phillips head screwdriver
RF cables
30 dB attenuator (High Power)

2.5.4 Setting the Synthesizer Frequency (units without M&C)

To set the synthesizer frequency perform the following:

1. Disconnect the IF input.
2. Remove the Summary alarm access cover with a flat screwdriver.
3. Locate the DIP switches.
4. Refer to the frequency chart at the end of the chapter to determine DIP switch setting required for the receive and transmit frequencies of your transceiver. The frequency chart lists each possible receive frequency and the corresponding transmit frequency, synthesizer frequency and

DIP switch settings. Note that tables are provided for both 70 and 140 MHz systems.
The calculations of transmit and receive frequencies assume a modem frequency of 70 or 140 MHz.

5. Set the dip switches according to the chart.

2.5.5 Power Level Settings Verification

2.5.5.1 IF Input

To set the power level of the modulator output:

1. Let the modem warm up for five minutes.
2. With a power meter or spectrum analyzer, measure the power level of the IF signal at the output of the 50Ω coaxial cable (RFU input). Adjust the modem for a reading of -30 dBm.
3. If -30 dBm cannot be achieved, attach an attenuator to the modem to obtain the proper level.
4. If the -30 dBm still cannot be achieved, check the modem and associated cable for proper operation.
5. Disconnect the power meter or spectrum analyzer from the coaxial cable.

2.5.5.2 Transmit RF Output Verification

This check assumes that the IF input is at the correct level.

1 Connect the IF input signal to J1 (TX IF IN) on the RFU and monitor the RF output with the power meter connected at waveguide output.
2 Verify that the output power is at cable power P1dB. If the proper level cannot be achieved, the RFU is faulty.
3. If the proper level can be achieved, the RFU is operating properly.

2.5.5.3 Receive IF Output Verification

1. Use a spectrum analyzer to measure the power level of the IF Receive signal at the IF OUT BNC connector (J1) on the LNC.
2. Observe that the noise pedestal is at -35 dBm on the spectrum analyzer. This is the level preset at the factory and this setting corresponds to a gain of 85 dB in the LNC (refer to Figure 2.5).
3. If the -35 dBm can be achieved, then the LNC is operating properly. Check the cables, driver and/or the demodulator for proper operation.
4. If -35 dBm noise pedestal cannot be achieved, then proceed with the DC/LO troubleshooting.

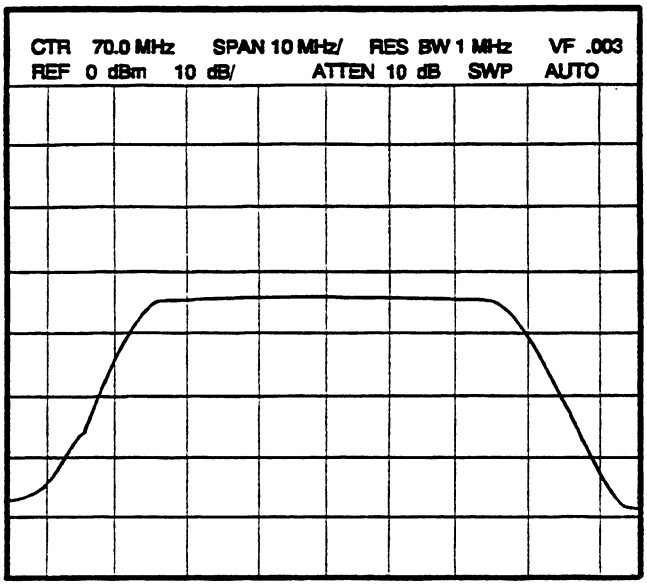


FIGURE 2.5 OUTPUT PEDESTAL AT -35 dBm

2.5.5.4 13 GHz LO

1. Connect a cable between RFU J8 and the spectrum analyzer. Set the spectrum analyzer to read the LO frequency between 12.710-13.360 GHz and a level of approximately +14 dBm.
2. Check the FAL DIP switch setting and record the settings. Refer to the Frequency Select Charts to determine the synthesizer frequency (x4).
3. Adjust the spectrum analyzer to verify that the output frequency is at the proper synthesizer frequency. Also check the output level for approximately +14 dBm.
4. If the proper frequency and level are not achieved, the RFU is faulty.
5. If the proper frequency and level are achieved, the RFU is functioning properly.

2.5.5.5 2nd/3rd LO

1. Connect a cable between RFU J9 and J10 and the spectrum analyzer. Set the spectrum analyzer to read the LO frequency between 300-1200 MHz and a level of approximately +8 dBm.
2. Refer to Figure 3.1, (Section 3.0) to determine the actual frequencies to be measured.
3. Adjust the spectrum analyzer to verify that the output frequency is at the proper synthesizer frequency. Also check the output level for approximately +6 dBm.
4. If the proper frequency and level are not achieved, the RFU is faulty.
5. If the proper frequency and level are achieved, the RF unit is functioning properly.

2.6 SYNTHESIZER FREQUENCY SWITCH SETTINGS

2.6.1 General

RF driver uplink and downlink frequency selections are set manually via DIP switches located inside the RF unit. See Figure 2.6 for switch locations.

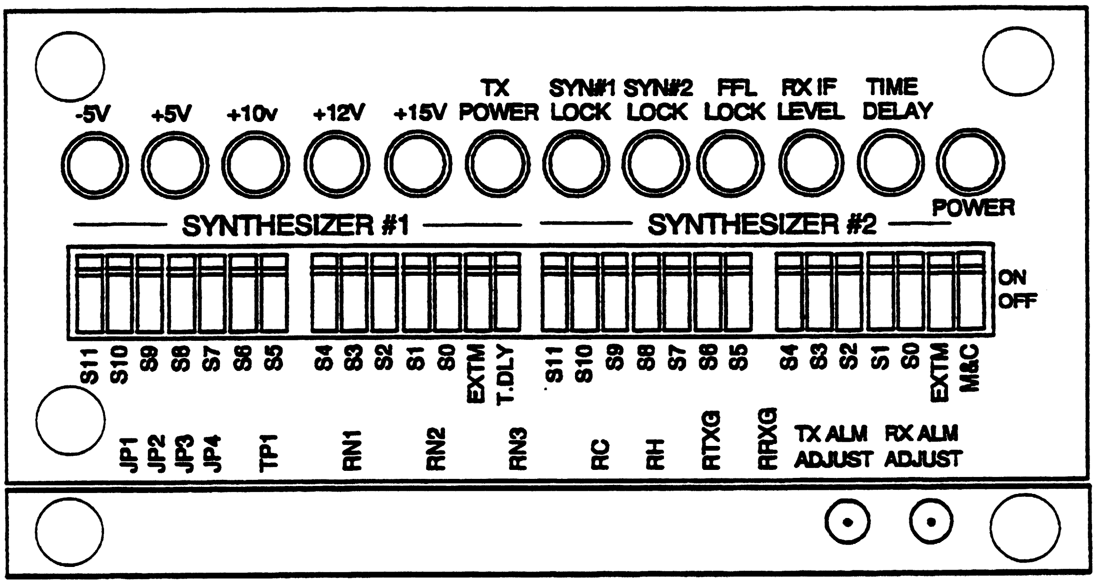


FIGURE 2.6 SUMMARY ALARM

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)	Eu (9-17)															
M&C								1	1	1	1	1	1	1	1	1	1	1	1
14000	11700	10950		12500	12250	11450	12780	0	0	0	0	0	0	0	1	1	0	1	0
14001	11701	10951		12501	12251	11451	12781	1	1	0	0	1	0	0	0	1	0	1	0
14002	11702	10952		12502	12252	11452	12782	1	1	0	0	0	0	0	0	1	0	1	0
14003	11703	10953		12503	12253	11453	12783	1	0	1	1	1	0	0	0	1	0	1	0
14004	11704	10954		12504	12254	11454	12784	1	0	1	1	0	0	0	0	1	0	1	0
14005	11705	10955		12505	12255	11455	12785	1	0	1	0	1	0	0	0	1	0	1	0
14006	11706	10956		12506	12256	11456	12786	1	0	1	0	0	0	0	0	1	0	1	0
14007	11707	10957		12507	12257	11457	12787	1	0	0	1	1	0	0	0	1	0	1	0
14008	11708	10958		12508	12258	11458	12788	1	0	0	1	0	0	0	0	1	0	1	0
14009	11709	10959		12509	12259	11459	12789	1	0	0	0	1	0	0	0	1	0	1	0
14010	11710	10960		12510	12260	11460	12790	1	0	0	0	0	0	0	0	1	0	1	0
14011	11711	10961		12511	12261	11461	12791	0	1	0	0	1	0	0	0	1	0	1	0
14012	11712	10962		12512	12262	11462	12792	0	1	0	0	0	0	0	0	1	0	1	0
14013	11713	10963		12513	12263	11463	12793	0	0	1	1	1	0	0	0	1	0	1	0
14014	11714	10964		12514	12264	11464	12794	0	0	1	1	0	0	0	0	1	0	1	0
14015	11715	10965		12515	12265	11465	12795	0	0	1	0	1	0	0	0	1	0	1	0
14016	11716	10966		12516	12266	11466	12796	0	0	1	0	0	0	0	0	1	0	1	0
14017	11717	10967		12517	12267	11467	12797	0	0	0	1	1	0	0	0	1	0	1	0
14018	11718	10968		12518	12268	11468	12798	0	0	0	1	0	0	0	0	1	0	1	0
14019	11719	10969		12519	12269	11469	12799	0	0	0	0	1	0	0	0	1	0	1	0
14020	11720	10970		12520	12270	11470	12800	0	0	0	0	0	0	0	0	1	0	1	0
14021	11721	10971		12521	12271	11471	12801	1	1	0	0	1	1	0	0	1	0	0	1
14022	11722	10972		12522	12272	11472	12802	1	1	0	0	0	1	0	0	1	0	0	1
14023	11723	10973		12523	12273	11473	12803	1	0	1	1	1	1	0	0	1	0	0	1
14024	11724	10974		12524	12274	11474	12804	1	0	1	1	0	1	0	0	1	0	0	1
14025	11725	10975		12525	12275	11475	12805	1	0	1	0	1	1	0	0	1	0	0	1
14026	11726	10976		12526	12276	11476	12806	1	0	1	0	0	1	0	0	1	0	0	1
14027	11727	10977		12527	12277	11477	12807	1	0	0	1	1	1	0	0	1	0	0	1
14028	11728	10978		12528	12278	11478	12808	1	0	0	1	0	1	0	0	1	0	0	1
14029	11729	10979		12529	12279	11479	12809	1	0	0	0	1	1	0	0	1	0	0	1
14030	11730	10980		12530	12280	11480	12810	1	0	0	0	0	1	0	0	1	0	0	1
14031	11731	10981		12531	12281	11481	12811	0	1	0	0	1	1	0	0	1	0	0	1
14032	11732	10982		12532	12282	11482	12812	0	1	0	0	0	1	0	0	1	0	0	1
14033	11733	10983		12533	12283	11483	12813	0	0	1	1	1	1	0	0	1	0	0	1
14034	11734	10984		12534	12284	11484	12814	0	0	1	1	0	1	0	0	1	0	0	1
14035	11735	10985		12535	12285	11485	12815	0	0	1	0	1	1	0	0	1	0	0	1
14036	11736	10986		12536	12286	11486	12816	0	0	1	0	0	1	0	0	1	0	0	1
14037	11737	10987		12537	12287	11487	12817	0	0	0	1	1	1	0	0	1	0	0	1
14038	11738	10988		12538	12288	11488	12818	0	0	0	1	0	1	0	0	1	0	0	1
14039	11739	10989		12539	12289	11489	12819	0	0	0	0	1	1	0	0	1	0	0	1
14040	11740	10990		12540	12290	11490	12820	0	0	0	0	0	1	0	0	1	0	0	1

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO	F					P			N			
	Noram	Intel	Intel	Eutel	Aus	Panam		10	8	4	2	1	4	2	1	8	4	2	1
		LO	HI					S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	ORION		ORION	ORION															
	N. Am		Eu (1-8)	Eu (9-17)															
14041	11741	10991		12541	12291	11491	12821	1	1	0	0	1	0	1	1	1	0	0	1
14042	11742	10992		12542	12292	11492	12822	1	1	0	0	0	0	1	1	1	0	0	1
14043	11743	10993		12543	12293	11493	12823	1	0	1	1	1	0	1	1	1	0	0	1
14044	11744	10994		12544	12294	11494	12824	1	0	1	1	0	0	1	1	1	0	0	1
14045	11745	10995		12545	12295	11495	12825	1	0	1	0	1	0	1	1	1	0	0	1
14046	11746	10996		12546	12296	11496	12826	1	0	1	0	0	0	1	1	1	0	0	1
14047	11747	10997		12547	12297	11497	12827	1	0	0	1	1	0	1	1	1	0	0	1
14048	11748	10998		12548	12298	11498	12828	1	0	0	1	0	0	1	1	1	0	0	1
14049	11749	10999		12549	12299	11499	12829	1	0	0	0	1	0	1	1	1	0	0	1
14050	11750	11000		12550	12300	11500	12830	1	0	0	0	0	0	1	1	1	0	0	1
14051	11751	11001		12551	12301	11501	12831	0	1	0	0	1	0	1	1	1	0	0	1
14052	11752	11002		12552	12302	11502	12832	0	1	0	0	0	0	1	1	1	0	0	1
14053	11753	11003		12553	12303	11503	12833	0	0	1	1	1	0	1	1	1	0	0	1
14054	11754	11004		12554	12304	11504	12834	0	0	1	1	0	0	1	1	1	0	0	1
14055	11755	11005		12555	12305	11505	12835	0	0	1	0	1	0	1	1	1	0	0	1
14056	11756	11006		12556	12306	11506	12836	0	0	1	0	0	0	1	1	1	0	0	1
14057	11757	11007		12557	12307	11507	12837	0	0	0	1	1	0	1	1	1	0	0	1
14058	11758	11008		12558	12308	11508	12838	0	0	0	1	0	0	1	1	1	0	0	1
14059	11759	11009		12559	12309	11509	12839	0	0	0	0	1	0	1	1	1	0	0	1
14060	11760	11010		12560	12310	11510	12840	0	0	0	0	0	0	1	1	1	0	0	1
14061	11761	11011		12561	12311	11511	12841	1	1	0	0	1	0	1	0	1	0	0	1
14062	11762	11012		12562	12312	11512	12842	1	1	0	0	0	0	1	0	1	0	0	1
14063	11763	11013		12563	12313	11513	12843	1	0	1	1	1	0	1	0	1	0	0	1
14064	11764	11014		12564	12314	11514	12844	1	0	1	1	0	0	1	0	1	0	0	1
14065	11765	11015		12565	12315	11515	12845	1	0	1	0	1	0	1	0	1	0	0	1
14066	11766	11016		12566	12316	11516	12846	1	0	1	0	0	0	1	0	1	0	0	1
14067	11767	11017		12567	12317	11517	12847	1	0	0	1	1	0	1	0	1	0	0	1
14068	11768	11018		12568	12318	11518	12848	1	0	0	1	0	0	1	0	1	0	0	1
14069	11769	11019		12569	12319	11519	12849	1	0	0	0	1	0	1	0	1	0	0	1
14070	11770	11020		12570	12320	11520	12850	1	0	0	0	0	0	1	0	1	0	0	1
14071	11771	11021		12571	12321	11521	12851	0	1	0	0	1	0	1	0	1	0	0	1
14072	11772	11022		12572	12322	11522	12852	0	1	0	0	0	0	1	0	1	0	0	1
14073	11773	11023		12573	12323	11523	12853	0	0	1	1	1	0	1	0	1	0	0	1
14074	11774	11024		12574	12324	11524	12854	0	0	1	1	0	0	1	0	1	0	0	1
14075	11775	11025		12575	12325	11525	12855	0	0	1	0	1	0	1	0	1	0	0	1
14076	11776	11026		12576	12326	11526	12856	0	0	1	0	0	0	1	0	1	0	0	1
14077	11777	11027		12577	12327	11527	12857	0	0	0	1	1	0	1	0	1	0	0	1
14078	11778	11028		12578	12328	11528	12858	0	0	0	1	0	0	1	0	1	0	0	1
14079	11779	11029		12579	12329	11529	12859	0	0	0	0	1	0	1	0	1	0	0	1
14080	11780	11030		12580	12330	11530	12860	0	0	0	0	0	0	1	0	1	0	0	1

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)	Eu (9-17)															
14081	11781	11031		12581	12331	11531	12861	1	1	0	0	1	0	0	1	1	0	0	1
14082	11782	11032		12582	12332	11532	12862	1	1	0	0	0	0	0	1	1	0	0	1
14083	11783	11033		12583	12333	11533	12863	1	0	1	1	1	0	0	1	1	0	0	1
14084	11784	11034		12584	12334	11534	12864	1	0	1	1	0	0	0	1	1	0	0	1
14085	11785	11035		12585	12335	11535	12865	1	0	1	0	1	0	0	1	1	0	0	1
14086	11786	11036		12586	12336	11536	12866	1	0	1	0	0	0	0	1	1	0	0	1
14087	11787	11037		12587	12337	11537	12867	1	0	0	1	1	0	0	1	1	0	0	1
14088	11788	11038		12588	12338	11538	12868	1	0	0	1	0	0	0	1	1	0	0	1
14089	11789	11039		12589	12339	11539	12869	1	0	0	0	1	0	0	1	1	0	0	1
14090	11790	11040		12590	12340	11540	12870	1	0	0	0	0	0	0	1	1	0	0	1
14091	11791	11041		12591	12341	11541	12871	0	1	0	0	1	0	0	1	1	0	0	1
14092	11792	11042		12592	12342	11542	12872	0	1	0	0	0	0	0	1	1	0	0	1
14093	11793	11043		12593	12343	11543	12873	0	0	1	1	1	0	0	1	1	0	0	1
14094	11794	11044		12594	12344	11544	12874	0	0	1	1	0	0	0	1	1	0	0	1
14095	11795	11045		12595	12345	11545	12875	0	0	1	0	1	0	0	1	1	0	0	1
14096	11796	11046		12596	12346	11546	12876	0	0	1	0	0	0	0	1	1	0	0	1
14097	11797	11047		12597	12347	11547	12877	0	0	0	1	1	0	0	1	1	0	0	1
14098	11798	11048		12598	12348	11548	12878	0	0	0	1	0	0	0	1	1	0	0	1
14099	11799	11049		12599	12349	11549	12879	0	0	0	0	1	0	0	1	1	0	0	1
14100	11800	11050		12600	12350	11550	12880	0	0	0	0	0	0	0	1	1	0	0	1
14101	11801	11051		12601	12351	11551	12881	1	1	0	0	1	0	0	0	1	0	0	1
14102	11802	11052		12602	12352	11552	12882	1	1	0	0	0	0	0	0	1	0	0	1
14103	11803	11053		12603	12353	11553	12883	1	0	1	1	1	0	0	0	1	0	0	1
14104	11804	11054		12604	12354	11554	12884	1	0	1	1	0	0	0	0	1	0	0	1
14105	11805	11055		12605	12355	11555	12885	1	0	1	0	1	0	0	0	1	0	0	1
14106	11806	11056		12606	12356	11556	12886	1	0	1	0	0	0	0	0	1	0	0	1
14107	11807	11057		12607	12357	11557	12887	1	0	0	1	1	0	0	0	1	0	0	1
14108	11808	11058		12608	12358	11558	12888	1	0	0	1	0	0	0	0	1	0	0	1
14109	11809	11059		12609	12359	11559	12889	1	0	0	0	1	0	0	0	1	0	0	1
14110	11810	11060		12610	12360	11560	12890	1	0	0	0	0	0	0	0	1	0	0	1
14111	11811	11061		12611	12361	11561	12891	0	1	0	0	1	0	0	0	1	0	0	1
14112	11812	11062		12612	12362	11562	12892	0	1	0	0	0	0	0	0	1	0	0	1
14113	11813	11063		12613	12363	11563	12893	0	0	1	1	1	0	0	0	1	0	0	1
14114	11814	11064		12614	12364	11564	12894	0	0	1	1	0	0	0	0	1	0	0	1
14115	11815	11065		12615	12365	11565	12895	0	0	1	0	1	0	0	0	1	0	0	1
14116	11816	11066		12616	12366	11566	12896	0	0	1	0	0	0	0	0	1	0	0	1
14117	11817	11067		12617	12367	11567	12897	0	0	0	1	1	0	0	0	1	0	0	1
14118	11818	11068		12618	12368	11568	12898	0	0	0	1	0	0	0	0	1	0	0	1
14119	11819	11069		12619	12369	11569	12899	0	0	0	0	1	0	0	0	1	0	0	1
14120	11820	11070		12620	12370	11570	12900	0	0	0	0	0	0	0	0	1	0	0	1

70 MHz IF DIP SWITCH SETTINGS

XTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)	Eu (9-17)															
14121	11821	11071		12621	12371	11571	12901	1	1	0	0	1	1	0	0	1	0	0	0
14122	11822	11072		12622	12372	11572	12902	1	1	0	0	0	1	0	0	1	0	0	0
14123	11823	11073		12623	12373	11573	12903	1	0	1	1	1	1	0	0	1	0	0	0
14124	11824	11074		12624	12374	11574	12904	1	0	1	1	0	1	0	0	1	0	0	0
14125	11825	11075		12625	12375	11575	12905	1	0	1	0	1	1	0	0	1	0	0	0
14126	11826	11076		12626	12376	11576	12906	1	0	1	0	0	1	0	0	1	0	0	0
14127	11827	11077		12627	12377	11577	12907	1	0	0	1	1	1	0	0	1	0	0	0
14128	11828	11078		12628	12378	11578	12908	1	0	0	1	0	1	0	0	1	0	0	0
14129	11829	11079		12629	12379	11579	12909	1	0	0	0	1	1	0	0	1	0	0	0
14130	11830	11080		12630	12380	11580	12910	1	0	0	0	0	1	0	0	1	0	0	0
14131	11831	11081		12631	12381	11581	12911	0	1	0	0	1	1	0	0	1	0	0	0
14132	11832	11082		12632	12382	11582	12912	0	1	0	0	0	1	0	0	1	0	0	0
14133	11833	11083		12633	12383	11583	12913	0	0	1	1	1	1	0	0	1	0	0	0
14134	11834	11084		12634	12384	11584	12914	0	0	1	1	0	1	0	0	1	0	0	0
14135	11835	11085		12635	12385	11585	12915	0	0	1	0	1	1	0	0	1	0	0	0
14136	11836	11086		12636	12386	11586	12916	0	0	1	0	0	1	0	0	1	0	0	0
14137	11837	11087		12637	12387	11587	12917	0	0	0	1	1	1	0	0	1	0	0	0
14138	11838	11088		12638	12388	11588	12918	0	0	0	1	0	1	0	0	1	0	0	0
14139	11839	11089		12639	12389	11589	12919	0	0	0	0	1	1	0	0	1	0	0	0
14140	11840	11090		12640	12390	11590	12920	0	0	0	0	0	1	0	0	1	0	0	0
14141	11841	11091		12641	12391	11591	12921	1	1	0	0	1	0	1	1	1	0	0	0
14142	11842	11092		12642	12392	11592	12922	1	1	0	0	0	0	1	1	1	0	0	0
14143	11843	11093		12643	12393	11593	12923	1	0	1	1	1	0	1	1	1	0	0	0
14144	11844	11094		12644	12394	11594	12924	1	0	1	1	0	0	1	1	1	0	0	0
14145	11845	11095		12645	12395	11595	12925	1	0	1	0	1	0	1	1	1	0	0	0
14146	11846	11096		12646	12396	11596	12926	1	0	1	0	0	0	1	1	1	0	0	0
14147	11847	11097		12647	12397	11597	12927	1	0	0	1	1	0	1	1	1	0	0	0
14148	11848	11098		12648	12398	11598	12928	1	0	0	1	0	0	1	1	1	0	0	0
14149	11849	11099		12649	12399	11599	12929	1	0	0	0	1	0	1	1	1	0	0	0
14150	11850	11100		12650	12400	11600	12930	1	0	0	0	0	0	1	1	1	0	0	0
14151	11851	11101		12651	12401	11601	12931	0	1	0	0	1	0	1	1	1	0	0	0
14152	11852	11102		12652	12402	11602	12932	0	1	0	0	0	0	1	1	1	0	0	0
14153	11853	11103		12653	12403	11603	12933	0	0	1	1	1	0	1	1	1	0	0	0
14154	11854	11104		12654	12404	11604	12934	0	0	1	1	0	0	1	1	1	0	0	0
14155	11855	11105		12655	12405	11605	12935	0	0	1	0	1	0	1	1	1	0	0	0
14156	11856	11106		12656	12406	11606	12936	0	0	1	0	0	0	1	1	1	0	0	0
14157	11857	11107		12657	12407	11607	12937	0	0	0	1	1	0	1	1	1	0	0	0
14158	11858	11108		12658	12408	11608	12938	0	0	0	1	0	0	1	1	1	0	0	0
14159	11859	11109		12659	12409	11609	12939	0	0	0	0	1	0	1	1	1	0	0	0
14160	11860	11110		12660	12410	11610	12940	0	0	0	0	0	0	1	1	1	0	0	0

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)	Eu (9-17)															
14161	11861	11111		12661	12411	11611	12941	1	1	0	0	1	0	1	0	1	0	0	0
14162	11862	11112		12662	12412	11612	12942	1	1	0	0	0	0	1	0	1	0	0	0
14163	11863	11113		12663	12413	11613	12943	1	0	1	1	1	0	1	0	1	0	0	0
14164	11864	11114		12664	12414	11614	12944	1	0	1	1	0	0	1	0	1	0	0	0
14165	11865	11115		12665	12415	11615	12945	1	0	1	0	1	0	1	0	1	0	0	0
14166	11866	11116		12666	12416	11616	12946	1	0	1	0	0	0	1	0	1	0	0	0
14167	11867	11117		12667	12417	11617	12947	1	0	0	1	1	0	1	0	1	0	0	0
14168	11868	11118		12668	12418	11618	12948	1	0	0	1	0	0	1	0	1	0	0	0
14169	11869	11119		12669	12419	11619	12949	1	0	0	0	1	0	1	0	1	0	0	0
14170	11870	11120		12670	12420	11620	12950	1	0	0	0	0	0	1	0	1	0	0	0
14171	11871	11121		12671	12421	11621	12951	0	1	0	0	1	0	1	0	1	0	0	0
14172	11872	11122		12672	12422	11622	12952	0	1	0	0	0	0	1	0	1	0	0	0
14173	11873	11123		12673	12423	11623	12953	0	0	1	1	1	0	1	0	1	0	0	0
14174	11874	11124		12674	12424	11624	12954	0	0	1	1	0	0	1	0	1	0	0	0
14175	11875	11125		12675	12425	11625	12955	0	0	1	0	1	0	1	0	1	0	0	0
14176	11876	11126		12676	12426	11626	12956	0	0	1	0	0	0	1	0	1	0	0	0
14177	11877	11127		12677	12427	11627	12957	0	0	0	1	1	0	1	0	1	0	0	0
14178	11878	11128		12678	12428	11628	12958	0	0	0	1	0	0	1	0	1	0	0	0
14179	11879	11129		12679	12429	11629	12959	0	0	0	0	1	0	1	0	1	0	0	0
14180	11880	11130		12680	12430	11630	12960	0	0	0	0	0	0	1	0	1	0	0	0
14181	11881	11131		12681	12431	11631	12961	1	1	0	0	1	0	0	1	1	0	0	0
14182	11882	11132		12682	12432	11632	12962	1	1	0	0	0	0	0	1	1	0	0	0
14183	11883	11133		12683	12433	11633	12963	1	0	1	1	1	0	0	1	1	0	0	0
14184	11884	11134		12684	12434	11634	12964	1	0	1	1	0	0	0	1	1	0	0	0
14185	11885	11135		12685	12435	11635	12965	1	0	1	0	1	0	0	1	1	0	0	0
14186	11886	11136		12686	12436	11636	12966	1	0	1	0	0	0	0	1	1	0	0	0
14187	11887	11137		12687	12437	11637	12967	1	0	0	1	1	0	0	1	1	0	0	0
14188	11888	11138		12688	12438	11638	12968	1	0	0	1	0	0	0	1	1	0	0	0
14189	11889	11139		12689	12439	11639	12969	1	0	0	0	1	0	0	1	1	0	0	0
14190	11890	11140		12690	12440	11640	12970	1	0	0	0	0	0	0	1	1	0	0	0
14191	11891	11141		12691	12441	11641	12971	0	1	0	0	1	0	0	1	1	0	0	0
14192	11892	11142		12692	12442	11642	12972	0	1	0	0	0	0	0	1	1	0	0	0
14193	11893	11143		12693	12443	11643	12973	0	0	1	1	1	0	0	1	1	0	0	0
14194	11894	11144		12694	12444	11644	12974	0	0	1	1	0	0	0	1	1	0	0	0
14195	11895	11145		12695	12445	11645	12975	0	0	1	0	1	0	0	1	1	0	0	0
14196	11896	11146		12696	12446	11646	12976	0	0	1	0	0	0	0	1	1	0	0	0
14197	11897	11147		12697	12447	11647	12977	0	0	0	1	1	0	0	1	1	0	0	0
14198	11898	11148		12698	12448	11648	12978	0	0	0	1	0	0	0	1	1	0	0	0
14199	11899	11149		12699	12449	11649	12979	0	0	0	0	1	0	0	1	1	0	0	0
14200	11900	11150		12700	12450	11650	12980	0	0	0	0	0	0	0	1	1	0	0	0

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)	Eu (9-17)															
14201	11901	11151		12701	12451	11651	12981	1	1	0	0	1	0	0	0	1	0	0	0
14202	11902	11152		12702	12452	11652	12982	1	1	0	0	0	0	0	0	1	0	0	0
14203	11903	11153		12703	12453	11653	12983	1	0	1	1	1	0	0	0	1	0	0	0
14204	11904	11154		12704	12454	11654	12984	1	0	1	1	0	0	0	0	1	0	0	0
14205	11905	11155		12705	12455	11655	12985	1	0	1	0	1	0	0	0	1	0	0	0
14206	11906	11156		12706	12456	11656	12986	1	0	1	0	0	0	0	0	1	0	0	0
14207	11907	11157		12707	12457	11657	12987	1	0	0	1	1	0	0	0	1	0	0	0
14208	11908	11158		12708	12458	11658	12988	1	0	0	1	0	0	0	0	1	0	0	0
14209	11909	11159		12709	12459	11659	12989	1	0	0	0	1	0	0	0	1	0	0	0
14210	11910	11160		12710	12460	11660	12990	1	0	0	0	0	0	0	0	1	0	0	0
14211	11911	11161		12711	12461	11661	12991	0	1	0	0	1	0	0	0	1	0	0	0
14212	11912	11162		12712	12462	11662	12992	0	1	0	0	0	0	0	0	1	0	0	0
14213	11913	11163		12713	12463	11663	12993	0	0	1	1	1	0	0	0	1	0	0	0
14214	11914	11164		12714	12464	11664	12994	0	0	1	1	0	0	0	0	1	0	0	0
14215	11915	11165		12715	12465	11665	12995	0	0	1	0	1	0	0	0	1	0	0	0
14216	11916	11166		12716	12466	11666	12996	0	0	1	0	0	0	0	0	1	0	0	0
14217	11917	11167		12717	12467	11667	12997	0	0	0	1	1	0	0	0	1	0	0	0
14218	11918	11168		12718	12468	11668	12998	0	0	0	1	0	0	0	0	1	0	0	0
14219	11919	11169		12719	12469	11669	12999	0	0	0	0	1	0	0	0	1	0	0	0
14220	11920	11170		12720	12470	11670	13000	0	0	0	0	0	0	0	0	1	0	0	0
14221	11921	11171		12721	12471	11671	13001	1	1	0	0	1	1	0	0	0	1	1	1
14222	11922	11172		12722	12472	11672	13002	1	1	0	0	0	1	0	0	0	1	1	1
14223	11923	11173		12723	12473	11673	13003	1	0	1	1	1	1	0	0	0	1	1	1
14224	11924	11174		12724	12474	11674	13004	1	0	1	1	0	1	0	0	0	1	1	1
14225	11925	11175		12725	12475	11675	13005	1	0	1	0	1	1	0	0	0	1	1	1
14226	11926	11176		12726	12476	11676	13006	1	0	1	0	0	1	0	0	0	1	1	1
14227	11927	11177		12727	12477	11677	13007	1	0	0	1	1	1	0	0	0	1	1	1
14228	11928	11178		12728	12478	11678	13008	1	0	0	1	0	1	0	0	0	1	1	1
14229	11929	11179		12729	12479	11679	13009	1	0	0	0	1	1	0	0	0	1	1	1
14230	11930	11180		12730	12480	11680	13010	1	0	0	0	0	1	0	0	0	1	1	1
14231	11931	11181		12731	12481	11681	13011	0	1	0	0	1	1	0	0	0	1	1	1
14232	11932	11182		12732	12482	11682	13012	0	1	0	0	0	1	0	0	0	1	1	1
14233	11933	11183		12733	12483	11683	13013	0	0	1	1	1	1	0	0	0	1	1	1
14234	11934	11184		12734	12484	11684	13014	0	0	1	1	0	1	0	0	0	1	1	1
14235	11935	11185		12735	12485	11685	13015	0	0	1	0	1	1	0	0	0	1	1	1
14236	11936	11186		12736	12486	11686	13016	0	0	1	0	0	1	0	0	0	1	1	1
14237	11937	11187		12737	12487	11687	13017	0	0	0	1	1	1	0	0	0	1	1	1
14238	11938	11188		12738	12488	11688	13018	0	0	0	1	0	1	0	0	0	1	1	1
14239	11939	11189		12739	12489	11689	13019	0	0	0	0	1	1	0	0	0	1	1	1
14240	11940	11190		12740	12490	11690	13020	0	0	0	0	0	1	0	0	0	1	1	1

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)	Eu (9-17)															
14241	11941	11191		12741	12491	11691	13021	1	1	0	0	1	0	1	1	0	1	1	1
14242	11942	11192		12742	12492	11692	13022	1	1	0	0	0	0	1	1	0	1	1	1
14243	11943	11193		12743	12493	11693	13023	1	0	1	1	1	0	1	1	0	1	1	1
14244	11944	11194		12744	12494	11694	13024	1	0	1	1	0	0	1	1	0	1	1	1
14245	11945	11195		12745	12495	11695	13025	1	0	1	0	1	0	1	1	0	1	1	1
14246	11946	11196		12746	12496	11696	13026	1	0	1	0	0	0	1	1	0	1	1	1
14247	11947	11197		12747	12497	11697	13027	1	0	0	1	1	0	1	1	0	1	1	1
14248	11948	11198		12748	12498	11698	13028	1	0	0	1	0	0	1	1	0	1	1	1
14249	11949	11199		12749	12499	11699	13029	1	0	0	0	1	0	1	1	0	1	1	1
14250	11950	11200	11450	12750	12500	11700	13030	1	0	0	0	0	0	1	1	0	1	1	1
14251	11951		11451		12501	11701	13031	0	1	0	0	1	0	1	1	0	1	1	1
14252	11952		11452		12502	11702	13032	0	1	0	0	0	0	1	1	0	1	1	1
14253	11953		11453		12503	11703	13033	0	0	1	1	1	0	1	1	0	1	1	1
14254	11954		11454		12504	11704	13034	0	0	1	1	0	0	1	1	0	1	1	1
14255	11955		11455		12505	11705	13035	0	0	1	0	1	0	1	1	0	1	1	1
14256	11956		11456		12506	11706	13036	0	0	1	0	0	0	1	1	0	1	1	1
14257	11957		11457		12507	11707	13037	0	0	0	1	1	0	1	1	0	1	1	1
14258	11958		11458		12508	11708	13038	0	0	0	1	0	0	1	1	0	1	1	1
14259	11959		11459		12509	11709	13039	0	0	0	0	1	0	1	1	0	1	1	1
14260	11960		11460		12510	11710	13040	0	0	0	0	0	0	1	1	0	1	1	1
14261	11961		11461		12511	11711	13041	1	1	0	0	1	0	1	0	0	1	1	1
14262	11962		11462		12512	11712	13042	1	1	0	0	0	0	1	0	0	1	1	1
14263	11963		11463		12513	11713	13043	1	0	1	1	1	0	1	0	0	1	1	1
14264	11964		11464		12514	11714	13044	1	0	1	1	0	0	1	0	0	1	1	1
14265	11965		11465		12515	11715	13045	1	0	1	0	1	0	1	0	0	1	1	1
14266	11966		11466		12516	11716	13046	1	0	1	0	0	0	1	0	0	1	1	1
14267	11967		11467		12517	11717	13047	1	0	0	1	1	0	1	0	0	1	1	1
14268	11968		11468		12518	11718	13048	1	0	0	1	0	0	1	0	0	1	1	1
14269	11969		11469		12519	11719	13049	1	0	0	0	1	0	1	0	0	1	1	1
14270	11970		11470		12520	11720	13050	1	0	0	0	0	0	1	0	0	1	1	1
14271	11971		11471		12521	11721	13051	0	1	0	0	1	0	1	0	0	1	1	1
14272	11972		11472		12522	11722	13052	0	1	0	0	0	0	1	0	0	1	1	1
14273	11973		11473		12523	11723	13053	0	0	1	1	1	0	1	0	0	1	1	1
14274	11974		11474		12524	11724	13054	0	0	1	1	0	0	1	0	0	1	1	1
14275	11975		11475		12525	11725	13055	0	0	1	0	1	0	1	0	0	1	1	1
14276	11976		11476		12526	11726	13056	0	0	1	0	0	0	1	0	0	1	1	1
14277	11977		11477		12527	11727	13057	0	0	0	1	1	0	1	0	0	1	1	1
14278	11978		11478		12528	11728	13058	0	0	0	1	0	0	1	0	0	1	1	1
14279	11979		11479		12529	11729	13059	0	0	0	0	1	0	1	0	0	1	1	1
14280	11980		11480		12530	11730	13060	0	0	0	0	0	0	1	0	0	1	1	1

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)	Eu (9-17)															
14281	11981		11481		12531	11731	13061	1	1	0	0	1	0	0	1	0	1	1	1
14282	11982		11482		12532	11732	13062	1	1	0	0	0	0	0	1	0	1	1	1
14283	11983		11483		12533	11733	13063	1	0	1	1	1	0	0	1	0	1	1	1
14284	11984		11484		12534	11734	13064	1	0	1	1	0	0	0	1	0	1	1	1
14285	11985		11485		12535	11735	13065	1	0	1	0	1	0	0	1	0	1	1	1
14286	11986		11486		12536	11736	13066	1	0	1	0	0	0	0	1	0	1	1	1
14287	11987		11487		12537	11737	13067	1	0	0	1	1	0	0	1	0	1	1	1
14288	11988		11488		12538	11738	13068	1	0	0	1	0	0	0	1	0	1	1	1
14289	11989		11489		12539	11739	13069	1	0	0	0	1	0	0	1	0	1	1	1
14290	11990		11490		12540	11740	13070	1	0	0	0	0	0	0	1	0	1	1	1
14291	11991		11491		12541	11741	13071	0	1	0	0	1	0	0	1	0	1	1	1
14292	11992		11492		12542	11742	13072	0	1	0	0	0	0	0	1	0	1	1	1
14293	11993		11493		12543	11743	13073	0	0	1	1	1	0	0	1	0	1	1	1
14294	11994		11494		12544	11744	13074	0	0	1	1	0	0	0	1	0	1	1	1
14295	11995		11495		12545	11745	13075	0	0	1	0	1	0	0	1	0	1	1	1
14296	11996		11496		12546	11746	13076	0	0	1	0	0	0	0	1	0	1	1	1
14297	11997		11497		12547	11747	13077	0	0	0	1	1	0	0	1	0	1	1	1
14298	11998		11498		12548	11748	13078	0	0	0	1	0	0	0	1	0	1	1	1
14299	11999		11499		12549	11749	13079	0	0	0	0	1	0	0	1	0	1	1	1
14300	12000		11500		12550	11750	13080	0	0	0	0	0	0	0	1	0	1	1	1
14301	12001		11501		12551	11751	13081	1	1	0	0	1	0	0	0	0	1	1	1
14302	12002		11502		12552	11752	13082	1	1	0	0	0	0	0	0	0	1	1	1
14303	12003		11503		12553	11753	13083	1	0	1	1	1	0	0	0	0	1	1	1
14304	12004		11504		12554	11754	13084	1	0	1	1	0	0	0	0	0	1	1	1
14305	12005		11505		12555	11755	13085	1	0	1	0	1	0	0	0	0	1	1	1
14306	12006		11506		12556	11756	13086	1	0	1	0	0	0	0	0	0	1	1	1
14307	12007		11507		12557	11757	13087	1	0	0	1	1	0	0	0	0	1	1	1
14308	12008		11508		12558	11758	13088	1	0	0	1	0	0	0	0	0	1	1	1
14309	12009		11509		12559	11759	13089	1	0	0	0	1	0	0	0	0	1	1	1
14310	12010		11510		12560	11760	13090	1	0	0	0	0	0	0	0	0	1	1	1
14311	12011		11511		12561	11761	13091	0	1	0	0	1	0	0	0	0	1	1	1
14312	12012		11512		12562	11762	13092	0	1	0	0	0	0	0	0	0	1	1	1
14313	12013		11513		12563	11763	13093	0	0	1	1	1	0	0	0	0	1	1	1
14314	12014		11514		12564	11764	13094	0	0	1	1	0	0	0	0	0	1	1	1
14315	12015		11515		12565	11765	13095	0	0	1	0	1	0	0	0	0	1	1	1
14316	12016		11516		12566	11766	13096	0	0	1	0	0	0	0	0	0	1	1	1
14317	12017		11517		12567	11767	13097	0	0	0	1	1	0	0	0	0	1	1	1
14318	12018		11518		12568	11768	13098	0	0	0	1	0	0	0	0	0	1	1	1
14319	12019		11519		12569	11769	13099	0	0	0	0	1	0	0	0	0	1	1	1
14320	12020		11520		12570	11770	13100	0	0	0	0	0	0	0	0	0	1	1	1

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX Noram ORION N. Am	RX Intel LO	RX Intel HI ORION Eu (1-8)	RX Eutel ORION Eu (9-17)	RX Aus	RX Panam	X4 LO	F 10 S11	F 8 S10	F 4 S9	F 2 S8	F 1 S7	P 4 S6	P 2 S5	P 1 S4	N 8 S3	N 4 S2	N 2 S1	N 1 S0
14321	12021		11521		12571	11771	13101	1	1	0	0	1	1	0	0	0	1	1	0
14322	12022		11522		12572	11772	13102	1	1	0	0	0	1	0	0	0	1	1	0
14323	12023		11523		12573	11773	13103	1	0	1	1	1	1	0	0	0	1	1	0
14324	12024		11524		12574	11774	13104	1	0	1	1	0	1	0	0	0	1	1	0
14325	12025		11525		12575	11775	13105	1	0	1	0	1	1	0	0	0	1	1	0
14326	12026		11526		12576	11776	13106	1	0	1	0	0	1	0	0	0	1	1	0
14327	12027		11527		12577	11777	13107	1	0	0	1	1	1	0	0	0	1	1	0
14328	12028		11528		12578	11778	13108	1	0	0	1	0	1	0	0	0	1	1	0
14329	12029		11529		12579	11779	13109	1	0	0	0	1	1	0	0	0	1	1	0
14330	12030		11530		12580	11780	13110	1	0	0	0	0	1	0	0	0	1	1	0
14331	12031		11531		12581	11781	13111	0	1	0	0	1	1	0	0	0	1	1	0
14332	12032		11532		12582	11782	13112	0	1	0	0	0	1	0	0	0	1	1	0
14333	12033		11533		12583	11783	13113	0	0	1	1	1	1	0	0	0	1	1	0
14334	12034		11534		12584	11784	13114	0	0	1	1	0	1	0	0	0	1	1	0
14335	12035		11535		12585	11785	13115	0	0	1	0	1	1	0	0	0	1	1	0
14336	12036		11536		12586	11786	13116	0	0	1	0	0	1	0	0	0	1	1	0
14337	12037		11537		12587	11787	13117	0	0	0	1	1	1	0	0	0	1	1	0
14338	12038		11538		12588	11788	13118	0	0	0	1	0	1	0	0	0	1	1	0
14339	12039		11539		12589	11789	13119	0	0	0	0	1	1	0	0	0	1	1	0
14340	12040		11540		12590	11790	13120	0	0	0	0	0	1	0	0	0	1	1	0
14341	12041		11541		12591	11791	13121	1	1	0	0	1	0	1	1	0	1	1	0
14342	12042		11542		12592	11792	13122	1	1	0	0	0	0	1	1	0	1	1	0
14343	12043		11543		12593	11793	13123	1	0	1	1	1	0	1	1	0	1	1	0
14344	12044		11544		12594	11794	13124	1	0	1	1	0	0	1	1	0	1	1	0
14345	12045		11545		12595	11795	13125	1	0	1	0	1	0	1	1	0	1	1	0
14346	12046		11546		12596	11796	13126	1	0	1	0	0	0	1	1	0	1	1	0
14347	12047		11547		12597	11797	13127	1	0	0	1	1	0	1	1	0	1	1	0
14348	12048		11548		12598	11798	13128	1	0	0	1	0	0	1	1	0	1	1	0
14349	12049		11549		12599	11799	13129	1	0	0	0	1	0	1	1	0	1	1	0
14350	12050		11550		12600	11800	13130	1	0	0	0	0	0	1	1	0	1	1	0
14351	12051		11551		12601	11801	13131	0	1	0	0	1	0	1	1	0	1	1	0
14352	12052		11552		12602	11802	13132	0	1	0	0	0	0	1	1	0	1	1	0
14353	12053		11553		12603	11803	13133	0	0	1	1	1	0	1	1	0	1	1	0
14354	12054		11554		12604	11804	13134	0	0	1	1	0	0	1	1	0	1	1	0
14355	12055		11555		12605	11805	13135	0	0	1	0	1	0	1	1	0	1	1	0
14356	12056		11556		12606	11806	13136	0	0	1	0	0	0	1	1	0	1	1	0
14357	12057		11557		12607	11807	13137	0	0	0	1	1	0	1	1	0	1	1	0
14358	12058		11558		12608	11808	13138	0	0	0	1	0	0	1	1	0	1	1	0
14359	12059		11559		12609	11809	13139	0	0	0	0	1	0	1	1	0	1	1	0
14360	12060		11560		12610	11810	13140	0	0	0	0	0	0	1	1	0	1	1	0

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO	F					P			N			
	Noram	Intel	Intel	Eutel	Aus	Panam		10	8	4	2	1	4	2	1	8	4	2	1
		LO	HI					S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	ORION		ORION	ORION															
	N. Am		Eu (1-8)	Eu (9-17)															
14361	12061		11561		12611	11811	13141	1	1	0	0	1	0	1	0	0	1	1	0
14362	12062		11562		12612	11812	13142	1	1	0	0	0	0	1	0	0	1	1	0
14363	12063		11563		12613	11813	13143	1	0	1	1	1	0	1	0	0	1	1	0
14364	12064		11564		12614	11814	13144	1	0	1	1	0	0	1	0	0	1	1	0
14365	12065		11565		12615	11815	13145	1	0	1	0	1	0	1	0	0	1	1	0
14366	12066		11566		12616	11816	13146	1	0	1	0	0	0	1	0	0	1	1	0
14367	12067		11567		12617	11817	13147	1	0	0	1	1	0	1	0	0	1	1	0
14368	12068		11568		12618	11818	13148	1	0	0	1	0	0	1	0	0	1	1	0
14369	12069		11569		12619	11819	13149	1	0	0	0	1	0	1	0	0	1	1	0
14370	12070		11570		12620	11820	13150	1	0	0	0	0	0	1	0	0	1	1	0
14371	12071		11571		12621	11821	13151	0	1	0	0	1	0	1	0	0	1	1	0
14372	12072		11572		12622	11822	13152	0	1	0	0	0	0	1	0	0	1	1	0
14373	12073		11573		12623	11823	13153	0	0	1	1	1	0	1	0	0	1	1	0
14374	12074		11574		12624	11824	13154	0	0	1	1	0	0	1	0	0	1	1	0
14375	12075		11575		12625	11825	13155	0	0	1	0	1	0	1	0	0	1	1	0
14376	12076		11576		12626	11826	13156	0	0	1	0	0	0	1	0	0	1	1	0
14377	12077		11577		12627	11827	13157	0	0	0	1	1	0	1	0	0	1	1	0
14378	12078		11578		12628	11828	13158	0	0	0	1	0	0	1	0	0	1	1	0
14379	12079		11579		12629	11829	13159	0	0	0	0	1	0	1	0	0	1	1	0
14380	12080		11580		12630	11830	13160	0	0	0	0	0	0	1	0	0	1	1	0
14381	12081		11581		12631	11831	13161	1	1	0	0	1	0	0	1	0	1	1	0
14382	12082		11582		12632	11832	13162	1	1	0	0	0	0	0	1	0	1	1	0
14383	12083		11583		12633	11833	13163	1	0	1	1	1	0	0	1	0	1	1	0
14384	12084		11584		12634	11834	13164	1	0	1	1	0	0	0	1	0	1	1	0
14385	12085		11585		12635	11835	13165	1	0	1	0	1	0	0	1	0	1	1	0
14386	12086		11586		12636	11836	13166	1	0	1	0	0	0	0	1	0	1	1	0
14387	12087		11587		12637	11837	13167	1	0	0	1	1	0	0	1	0	1	1	0
14388	12088		11588		12638	11838	13168	1	0	0	1	0	0	0	1	0	1	1	0
14389	12089		11589		12639	11839	13169	1	0	0	0	1	0	0	1	0	1	1	0
14390	12090		11590		12640	11840	13170	1	0	0	0	0	0	0	1	0	1	1	0
14391	12091		11591		12641	11841	13171	0	1	0	0	1	0	0	1	0	1	1	0
14392	12092		11592		12642	11842	13172	0	1	0	0	0	0	0	1	0	1	1	0
14393	12093		11593		12643	11843	13173	0	0	1	1	1	0	0	1	0	1	1	0
14394	12094		11594		12644	11844	13174	0	0	1	1	0	0	0	1	0	1	1	0
14395	12095		11595		12645	11845	13175	0	0	1	0	1	0	0	1	0	1	1	0
14396	12096		11596		12646	11846	13176	0	0	1	0	0	0	0	1	0	1	1	0
14397	12097		11597		12647	11847	13177	0	0	0	1	1	0	0	1	0	1	1	0
14398	12098		11598		12648	11848	13178	0	0	0	1	0	0	0	1	0	1	1	0
14399	12099		11599		12649	11849	13179	0	0	0	0	1	0	0	1	0	1	1	0
14400	12100		11600		12650	11850	13180	0	0	0	0	0	0	0	1	0	1	1	0

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)	Eu (9-17)															
14401	12101		11601		12651	11851	13181	1	1	0	0	1	0	0	0	0	1	1	0
14402	12102		11602		12652	11852	13182	1	1	0	0	0	0	0	0	0	1	1	0
14403	12103		11603		12653	11853	13183	1	0	1	1	1	0	0	0	0	1	1	0
14404	12104		11604		12654	11854	13184	1	0	1	1	0	0	0	0	0	1	1	0
14405	12105		11605		12655	11855	13185	1	0	1	0	1	0	0	0	0	1	1	0
14406	12106		11606		12656	11856	13186	1	0	1	0	0	0	0	0	0	1	1	0
14407	12107		11607		12657	11857	13187	1	0	0	1	1	0	0	0	0	1	1	0
14408	12108		11608		12658	11858	13188	1	0	0	1	0	0	0	0	0	1	1	0
14409	12109		11609		12659	11859	13189	1	0	0	0	1	0	0	0	0	1	1	0
14410	12110		11610		12660	11860	13190	1	0	0	0	0	0	0	0	0	1	1	0
14411	12111		11611		12661	11861	13191	0	1	0	0	1	0	0	0	0	1	1	0
14412	12112		11612		12662	11862	13192	0	1	0	0	0	0	0	0	0	1	1	0
14413	12113		11613		12663	11863	13193	0	0	1	1	1	0	0	0	0	1	1	0
14414	12114		11614		12664	11864	13194	0	0	1	1	0	0	0	0	0	1	1	0
14415	12115		11615		12665	11865	13195	0	0	1	0	1	0	0	0	0	1	1	0
14416	12116		11616		12666	11866	13196	0	0	1	0	0	0	0	0	0	1	1	0
14417	12117		11617		12667	11867	13197	0	0	0	1	1	0	0	0	0	1	1	0
14418	12118		11618		12668	11868	13198	0	0	0	1	0	0	0	0	0	1	1	0
14419	12119		11619		12669	11869	13199	0	0	0	0	1	0	0	0	0	1	1	0
14420	12120		11620		12670	11870	13200	0	0	0	0	0	0	0	0	0	1	1	0
14421	12121		11621		12671	11871	13201	1	1	0	0	1	1	0	0	0	1	0	1
14422	12122		11622		12672	11872	13202	1	1	0	0	0	1	0	0	0	1	0	1
14423	12123		11623		12673	11873	13203	1	0	1	1	1	1	0	0	0	1	0	1
14424	12124		11624		12674	11874	13204	1	0	1	1	0	1	0	0	0	1	0	1
14425	12125		11625		12675	11875	13205	1	0	1	0	1	1	0	0	0	1	0	1
14426	12126		11626		12676	11876	13206	1	0	1	0	0	1	0	0	0	1	0	1
14427	12127		11627		12677	11877	13207	1	0	0	1	1	1	0	0	0	1	0	1
14428	12128		11628		12678	11878	13208	1	0	0	1	0	1	0	0	0	1	0	1
14429	12129		11629		12679	11879	13209	1	0	0	0	1	1	0	0	0	1	0	1
14430	12130		11630		12680	11880	13210	1	0	0	0	0	1	0	0	0	1	0	1
14431	12131		11631		12681	11881	13211	0	1	0	0	1	1	0	0	0	1	0	1
14432	12132		11632		12682	11882	13212	0	1	0	0	0	1	0	0	0	1	0	1
14433	12133		11633		12683	11883	13213	0	0	1	1	1	1	0	0	0	1	0	1
14434	12134		11634		12684	11884	13214	0	0	1	1	0	1	0	0	0	1	0	1
14435	12135		11635		12685	11885	13215	0	0	1	0	1	1	0	0	0	1	0	1
14436	12136		11636		12686	11886	13216	0	0	1	0	0	1	0	0	0	1	0	1
14437	12137		11637		12687	11887	13217	0	0	0	1	1	1	0	0	0	1	0	1
14438	12138		11638		12688	11888	13218	0	0	0	1	0	1	0	0	0	1	0	1
14439	12139		11639		12689	11889	13219	0	0	0	0	1	1	0	0	0	1	0	1
14440	12140		11640		12690	11890	13220	0	0	0	0	0	1	0	0	0	1	0	1

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)	Eu (9-17)															
14441	12141		11641		12691	11891	13221	1	1	0	0	1	0	1	1	0	1	0	1
14442	12142		11642		12692	11892	13222	1	1	0	0	0	0	1	1	0	1	0	1
14443	12143		11643		12693	11893	13223	1	0	1	1	1	0	1	1	0	1	0	1
14444	12144		11644		12694	11894	13224	1	0	1	1	0	0	1	1	0	1	0	1
14445	12145		11645		12695	11895	13225	1	0	1	0	1	0	1	1	0	1	0	1
14446	12146		11646		12696	11896	13226	1	0	1	0	0	0	1	1	0	1	0	1
14447	12147		11647		12697	11897	13227	1	0	0	1	1	0	1	1	0	1	0	1
14448	12148		11648		12698	11898	13228	1	0	0	1	0	0	1	1	0	1	0	1
14449	12149		11649		12699	11899	13229	1	0	0	0	1	0	1	1	0	1	0	1
14450	12150		11650		12700	11900	13230	1	0	0	0	0	0	1	1	0	1	0	1
14451	12151		11651		12701	11901	13231	0	1	0	0	1	0	1	1	0	1	0	1
14452	12152		11652		12702	11902	13232	0	1	0	0	0	0	1	1	0	1	0	1
14453	12153		11653		12703	11903	13233	0	0	1	1	1	0	1	1	0	1	0	1
14454	12154		11654		12704	11904	13234	0	0	1	1	0	0	1	1	0	1	0	1
14455	12155		11655		12705	11905	13235	0	0	1	0	1	0	1	1	0	1	0	1
14456	12156		11656		12706	11906	13236	0	0	1	0	0	0	1	1	0	1	0	1
14457	12157		11657		12707	11907	13237	0	0	0	1	1	0	1	1	0	1	0	1
14458	12158		11658		12708	11908	13238	0	0	0	1	0	0	1	1	0	1	0	1
14459	12159		11659		12709	11909	13239	0	0	0	0	1	0	1	1	0	1	0	1
14460	12160		11660		12710	11910	13240	0	0	0	0	0	0	1	1	0	1	0	1
14461	12161		11661		12711	11911	13241	1	1	0	0	1	0	1	0	0	1	0	1
14462	12162		11662		12712	11912	13242	1	1	0	0	0	0	1	0	0	1	0	1
14463	12163		11663		12713	11913	13243	1	0	1	1	1	0	1	0	0	1	0	1
14464	12164		11664		12714	11914	13244	1	0	1	1	0	0	1	0	0	1	0	1
14465	12165		11665		12715	11915	13245	1	0	1	0	1	0	1	0	0	1	0	1
14466	12166		11666		12716	11916	13246	1	0	1	0	0	0	1	0	0	1	0	1
14467	12167		11667		12717	11917	13247	1	0	0	1	1	0	1	0	0	1	0	1
14468	12168		11668		12718	11918	13248	1	0	0	1	0	0	1	0	0	1	0	1
14469	12169		11669		12719	11919	13249	1	0	0	0	1	0	1	0	0	1	0	1
14470	12170		11670		12720	11920	13250	1	0	0	0	0	0	1	0	0	1	0	1
14471	12171		11671		12721	11921	13251	0	1	0	0	1	0	1	0	0	1	0	1
14472	12172		11672		12722	11922	13252	0	1	0	0	0	0	1	0	0	1	0	1
14473	12173		11673		12723	11923	13253	0	0	1	1	1	0	1	0	0	1	0	1
14474	12174		11674		12724	11924	13254	0	0	1	1	0	0	1	0	0	1	0	1
14475	12175		11675		12725	11925	13255	0	0	1	0	1	0	1	0	0	1	0	1
14476	12176		11676		12726	11926	13256	0	0	1	0	0	0	1	0	0	1	0	1
14477	12177		11677		12727	11927	13257	0	0	0	1	1	0	1	0	0	1	0	1
14478	12178		11678		12728	11928	13258	0	0	0	1	0	0	1	0	0	1	0	1
14479	12179		11679		12729	11929	13259	0	0	0	0	1	0	1	0	0	1	0	1
14480	12180		11680		12730	11930	13260	0	0	0	0	0	0	1	0	0	1	0	1

70 MHz IF DIP SWITCH SETTINGS

EXTM MODE ALWAYS = 1

TX	RX	RX	RX	RX	RX	RX	X4 LO												
	Noram	Intel	Intel	Eutel	Aus	Panam		F					P			N			
		LO	HI					10	8	4	2	1	4	2	1	8	4	2	1
	ORION		ORION	ORION				S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
	N. Am		Eu (1-8)																
14481	12181		11681		12731	11931	13261	1	1	0	0	1	0	0	1	0	1	0	1
14482	12182		11682		12732	11932	13262	1	1	0	0	0	0	0	1	0	1	0	1
14483	12183		11683		12733	11933	13263	1	0	1	1	1	0	0	1	0	1	0	1
14484	12184		11684		12734	11934	13264	1	0	1	1	0	0	0	1	0	1	0	1
14485	12185		11685		12735	11935	13265	1	0	1	0	1	0	0	1	0	1	0	1
14486	12186		11686		12736	11936	13266	1	0	1	0	0	0	0	1	0	1	0	1
14487	12187		11687		12737	11937	13267	1	0	0	1	1	0	0	1	0	1	0	1
14488	12188		11688		12738	11938	13268	1	0	0	1	0	0	0	1	0	1	0	1
14489	12189		11689		12739	11939	13269	1	0	0	0	1	0	0	1	0	1	0	1
14490	12190		11690		12740	11940	13270	1	0	0	0	0	0	0	1	0	1	0	1
14491	12191		11691		12741	11941	13271	0	1	0	0	1	0	0	1	0	1	0	1
14492	12192		11692		12742	11942	13272	0	1	0	0	0	0	0	1	0	1	0	1
14493	12193		11693		12743	11943	13273	0	0	1	1	1	0	0	1	0	1	0	1
14494	12194		11694		12744	11944	13274	0	0	1	1	0	0	0	1	0	1	0	1
14495	12195		11695		12745	11945	13275	0	0	1	0	1	0	0	1	0	1	0	1
14496	12196		11696		12746	11946	13276	0	0	1	0	0	0	0	1	0	1	0	1
14497	12197		11697		12747	11947	13277	0	0	0	1	1	0	0	1	0	1	0	1
14498	12198		11698		12748	11948	13278	0	0	0	1	0	0	0	1	0	1	0	1
14499	12199		11699		12749	11949	13279	0	0	0	0	1	0	0	1	0	1	0	1
14500	12200		11700		12750	11950	13280	0	0	0	0	0	0	0	1	0	1	0	1

SECTION 3.0 LOW NOISE CONVERTER UNIT

TABLE of CONTENTS

3.1 GENERAL

The Low Noise Converter (LNC) was designed to operate with any SSE Technologies Ku Band RF Transceiver. The LNC is available for either 70 MHz or 140 MHz modems.

Frequency options are provided for INTELSAT Low Band, INTELSAT High Band, PANAMSAT, NORAM, AUSSAT, EUTELSAT.

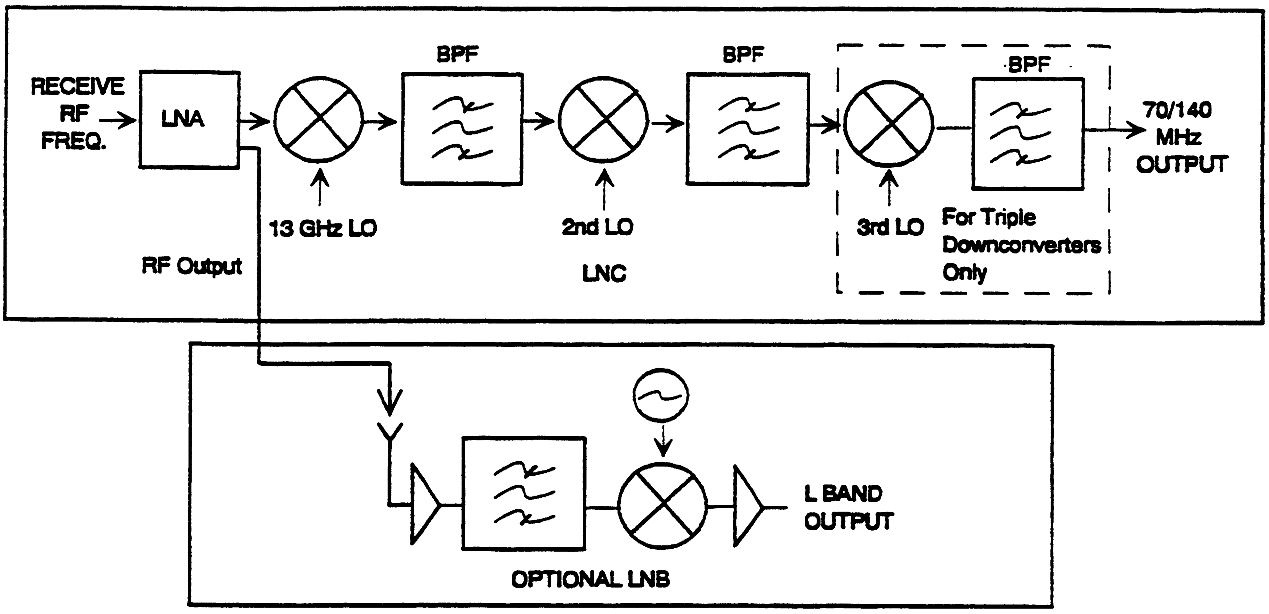
The LNA/LNC incorporates a low-noise, High Electron Mobility Transistor (HEMT) as well as Gallium Arsenide Field Effect Transistors (GaAsFET) to provide a system noise temperature of better than 200^{O} K. Lower noise figures of 110 & 160^{O} K are available as an option.

The LNC may be configured with an optional RF output port or an L-Band port.

3.2 FUNCTIONAL OPERATION

The function of the LNC is to amplify the received signal and downconvert the RF frequencies to either a 70 MHz or 140 MHz signal for output through the RF unit to a demodulator. Figure 3.1 provides a receive conversion chart and simplified block diagram of the downconversion process for the LNC.

The incoming RF downlink signal passes through a 14 GHz transmit reject filter. The filtered signal enters the LNC that contains a low noise amplifier section, filter sections and two or three downconversion stages depending upon the model. The first downconverter mixes the receive signal with an agile LO signal at a frequency of between 12.71 GHz and 13.36 GHz. The first IF receive signal is then filtered and mixed in the second converter with an 1150, 750, 700, 600, 500 or 350 MHz LO signal depending on the model. If the LNC is a triple downconverter with an additional LO, the IF is filtered and mixed in the third downconverter. The final IF signal is either 70)20 MHz or 140)40 MHz. The IF signal is then amplified and filtered.



RECEIVE CONVERSION CHART (70 MHz)

BAND	RF FREQ (MHz)	L BAND (MHz)	1st LO (MHz)	2nd LO (MHz)	3rd LO (MHz)
INTELSAT LB	10950 - 11200	950 - 1200	12780 - 13030	1150	750
INTELSAT HB/	11450 - 11700	1450 - 1700	13030 - 13280	1150	500
ORION (Eu, Tr 1-8)	11450 - 11700	1450 - 1700	13030 - 13280	1150	500
PANAMSAT	11450 - 11950	not available	12780 - 13280	700	700
NORAM/	11700 - 12200	950 - 1450	12780 - 13280	1150	—
ORION (N. Am)	11700 - 12200	950 - 1450	12780 - 13280	1150	—
AUSSAT	12250 - 12750	not available	12780 - 13280	600	—
EUTELSAT/	12500 - 12750	1025 - 1275	12780 - 13030	350	—
ORION (Eu, Tr 9-17)	12500 - 12750	1025 - 1275	12780 - 13030	350	—

RECEIVE CONVERSION CHART (140 MHz)

BAND	RF FREQ (MHz)	L BAND (MHz)	1st LO (MHz)	2nd LO (MHz)	3rd LO (MHz)
INTELSAT LB	10950 - 11200	950 - 1200	12710 - 12960	1150	750
INTELSAT HB/	11450 - 11700	1450 - 1700	12960 - 13210	1150	500
ORION (Eu, Tr 1-8)	11450 - 11700	1450 - 1700	12960 - 13210	1150	500
PANAMSAT	11450 - 11950	not available	12710 - 13210	700	700
NORAM/	11700 - 12200	950 - 1450	12710 - 13210	1150	—
ORION (N. Am)	11700 - 12200	950 - 1450	12710 - 13210	1150	—
AUSSAT	12250 - 12750	not available	12710 - 13210	600	—
EUTELSAT/	12500 - 12750	1025 - 1275	13110 - 13360	350	—
ORION (Eu, Tr 9-17)	12500 - 12750	1025 - 1275	13110 - 13360	350	—

Figure 3.1 LNC Unit Block Diagram & Conversion Frequency Chart

3.3 TYPICAL OPERATING PARAMETERS

NOTE: Operating parameters are subject to change without notice.

RECEIVER - INTERFACE

RF Input Flange	WR-75
RF Input VSWR	1.25:1 max.
IF Output Connector	BNC Type Female
IF Output Impedance	50 ohm nom.
IF Output VSWR	1.5:1 max.
L.O. Input Connector	SMA Female
L.O. Input Impedance	50 ohm nom.
L.O. Input VSWR	1.50:1 max.

RECEIVER - ELECTRICAL

RF INPUT FREQUENCY

10.950 - 11.200 GHz	INTELSAT LB
11.450 - 11.700 GHz	INTELSAT HB/ORION (Eu, Tr 1-8)
11.450 - 11.950 GHz	PANAMSAT
11.700 - 12.200 GHz	NORAM/ORION (N. Am)
12.250 - 12.750 GHz	AUSSAT
12.500 - 12.750 GHz	EUTELSAT/ORION (Eu, Tr 9-17)

**non standard frequency offset must be set in demodulator for single synthesizer units.*

IF Output Frequency	
70 MHz system	70.000 +/-20 MHz
140 MHz system	140.000 +/-40 MHz
IF Bandwidth	
70 MHz system	40 MHz
140 MHz system	80 MHz
IF Filter Rejection @ 25 MHz from	
Band Edge (70 MHz system)	20 dB min.
IF Filter Rejection @ 50 MHz from	20 dB min.
System Noise Figure @ 25^{o}C.	
200 K LNC	2.3 dB max.
160 K LNC (optional)	1.9 dB max.
110 K LNC (optional)	1.4 dB max.
Gain	85 dB min.
Gain flatness (500 MHz) @ 25^{o}C.	+/- 3 dB max. referenced to band center
Gain flatness (40 or 80 MHz) @ 25^{o}C.	2 dB p-p max.
Gain flatness (4 MHz) @ 25^{o}C.	0.5 dB p-p max.
Gain Variation over temp. 500 MHz (reference to gain @ 25^{o}C.	+/- 4.0 dB max.
1 dB Compression (P1dB) @ Receive IF @ 25^{o} C.	+7 dBm min.
Intermods (2 tones @ -89 dBm each/30 KHz apart)	-35 dBc max.
Image Rejection	>45 dB
Maximum Operational RF Input Level	-82 dBm
Receiver Monitor Level	20 dB below RX IF output nom.

RECEIVER - OPTIONAL OUTPUTS

RF PORT

RF OUTPUT FREQUENCY

10.950 - 11.200 GHz	INTELSAT LB
11.450 - 11.700 GHz	INTELSAT HB/ORION (Eu, Tr. 1-8)
11.450 - 11.950 GHz	PANAMSAT
11.700 - 12.200 GHz	NORAM/ORION (N. Am)
12.250 - 12.750 GHz	AUSSAT
12.500 - 12.750 GHz	EUTELSAT/ORION (Eu, Tr. 9-17)

**non standard frequency offset must be set in demodulator*

Connector	SMA female
Gain	20 dB min.
Gain Flatness	4 dB p-p max.
Impedance	50 ohm nominal
VSWR	2.5:1 max.

L-BAND PORT

FREQUENCY OUTPUT (based on the type of system)

SYSTEM TYPE	L-BAND PORT OUTPUT
INTELSAT LOW BAND (10.950-11.200 GHz)	950 to 1200 MHz
INTELSAT HIGH BAND/ORION (Eu, Tr 1-8) (11.450-11.700 GHz)	1450 to 1700 MHz
PANAMSAT (12.250-12.750 GHz)	Not available
NORAM/ORION (N. Am) (11.700-12.200 GHz)	950 to 1450 MHz
AUSSAT (12.250-12.750 GHz)	Not available
EUTELSAT/ORION (Eu, Tr 9-17) (12.500-12.750 GHz)	1025 to 1275 MHz
Conversion Gain	50 dB min.
Gain Flatness	6 dB p-p max.
Frequency Stability (-40^{o} to -60^{o} C)	+/- 2 MHz (+/-20 KHz optional)
VSWR	2.5:1 nominal
Impedance	75 ohm nominal
Connector	"F" type Female
DC Power (thru "F" connector)	+15 to +24 VDC 175 mA

LOCAL OSCILLATOR INPUT

High Frequency

LO Frequency	12.710 to 13.360 GHz
Level	+10 dBm min.
2nd LO Frequency	1150/750//700/600/500/350 MHz
Level	+6 dBm min.
3rd LO Frequency	750 or 500 MHz
Level	+6 dBm min.

POWER REQUIREMENTS	
Connector	4 Pin MS Male
DC Requirements	
A	Common
B	+10 VDC @.20A
C	-5 VDC @ .02A
D	Gain Control 0 to +8 VDC
Pin Configuration	
A	Ground
B	+10 VD
C	-5 VDC
D	0 to +8 VDC

ENVIRONMENTAL SPECIFICATIONS	
Ambient Temperature Conditions	
Operating	-30 to +60°C (VDE Approved) -40 to +60°C
Altitude	14,000 ft ASL max.
Humidity (condensing)	100% relative max.

MECHANICAL SPECIFICATIONS	
Weight	
LNC with TR Filter	.9 Kg (2 lbs)
Size	35.6 x 3.8 x 6.4 cm (14.0 x 1.5 x 3.5 in.)

SURFACE FINISH
Painted Surface
Color - White (per FED-STD-595A Spec No 604-27875), high solid Polyurethane, textured

3.4.3 Cable and Waveguide Connections for LNC

NOTE: Refer to Section 1.0, Figure 1.3 and 1.4 for system wiring diagrams

1. Connect the LNC (with T/R Filter attached) to the OMT receive Port per antenna manufacturer's instructions. Ensure that an O-ring is fitted into the wave guide flange groove.
2. Attach the LNC IF cable between LNC connector J1 and RFU connector J7.
3. Attach the LNC DC cable between LNC connector J2 and RFU connector J6.
4. Attach the 2nd LO cable between LNC connector J3 and RFU connector J9.
5. Attach the 13 GHz LO cable between LNC connector J4 and RFU connector J8.
6. If the system is equipped with the optional 3rd LO, connect the cables as follows:

RFU	LNC
J8	J4
J9	J5
J10	J3

3.4.4 Water Resistant Wrap

The application of moisture resistant wrap (mastic tape) to all connectors is recommended to prevent water entry and resultant water damage. Apply the mastic tape as follows:

1. Ensure that all connectors are tight.
2. Precut the mastic tape to the desired size.
3. Center the tape on the connector to be sealed and wrap the tape tightly around the connector. Squeeze the tape tightly and ensure that both ends of the tape have formed around the connector and the cable.
4. Apply the tape to all connectors that may be exposed to moisture.

3.4.5 Grounding

The electrical bonding (grounding) of the driver, RFU and LNC units is recommended to prevent possible damage from lightning and/or other induced electrical surges.

The RF unit is provided with grounding lugs. It is recommended that 000 AWG multiconductor copper wire be used for bonding units together and to the earth ground (grounding rod), using the most direct (shortest) routes possible.

3.5 TROUBLESHOOTING

The LNC gain is factory set prior to shipment. No alignment, routine adjustments or operating set-up procedures are required. If the LNC is suspected of being faulty, follow the procedure below.

3.5.1 General

Before troubleshooting the LNC, the antenna should be set to the desired azimuth and elevation settings, per manufacturer's instructions.

CAUTION: The Transceiver MUST NOT transmit until alignment and any necessary adjustments are completed.

Make sure that the TX IF INPUT (J1) is disconnected at the RF unit to prevent accidental transmission interference with adjacent satellites or transponders before attempting to align, or performing any other operation involving the RFU. Before attempting any system change, carefully evaluate the possible effects on the transmitted signal.

3.5.2 Test Equipment

The following test equipment or equivalent is recommended for installation, system alignment and troubleshooting.

Spectrum Analyzer HP 8569A
Power Meter HP 436A
Power Heads HP 8481H, HP 8484A
Digital Volt Meter Fluke 8050
Adapter WR-75 to Coax (calibrated insertion loss estimated @ 15 GHz)
Assortment of cables, connectors and adapters (calibrated @ 15 GHz)
Philips head screwdriver
RF cable
30 dB attenuator
SMA to N adapter

3.5.3 LNC Receive IF Output Verification

1. Use a spectrum analyzer to measure the power level of the IF receive signal at the IF OUT BNC connector J1 on the LNC.
2. Observe that the noise pedestal is approximately -35 dBm on the spectrum analyzer. This is the level preset at the factory and corresponds to a gain of 85 dB in the LNC (refer to Section 2.0, Figure 2.8).
3. If the -35 dBm can be achieved then the LNC is operating properly. Check the cables, RFU and/or the demodulator for proper operation.
4. If -35 dBm noise pedestal cannot be achieved, then proceed with the LO/DC troubleshooting.

3.5.4 LO Troubleshooting

1. Refer to Section 1. Figure 1.3A and 1.3B system cabling diagram.
2. Disconnect the cable on LNC J4 and connect it to the spectrum analyzer. Set the spectrum analyzer to read the LO frequency between 12.710-13.360 GHz and a level of approximately +10 dBm.
3. Check the synthesizer DIP switch setting of the summary panel and record the settings. Refer to the Frequency Select Chart to determine the synthesizer frequency (X4).
4. Adjust the spectrum analyzer to verify that the output frequency is at the proper synthesizer frequency. Also check the output level for approximately +10 dBm.
5. If the proper frequency and level is not present refer to RFU LO troubleshooting (Section 2.0).
6. If the proper frequency and level is measured reconnect the 13 GHz LO cable to LNC J4.
7. Disconnect the cable at LNC J3 and/or J5 (depending upon the LNC type) and connect it to the spectrum analyzer.
8. Refer to Figure 3.1 to determine actual frequencies to be measured.
9. Adjust the spectrum analyzer to verify that the output frequency is at the proper synthesizer frequency. Also check the output level for approximately +6 dBm.
10. If the proper frequency and level is not measured, reconnect the cable or cables to LNC J3 and/or J5 and refer the RFU LO Troubleshooting (Section 2.0).

3.5.5 DC Troubleshooting

1. Refer to the DC wiring diagram in Figure 1.4 (Section 1.0)
2. Remove connector J2 from the LNC.
3. Set the multimeter to read 20 VDC.
4. Connect the negative lead of the multimeter to the cable connector Pin A. Connect the positive lead to the following pins and measure.

Pin	Measured Voltage
B	+10 VDC +1/-0.2 VDC
C	- 5 VDC +/-0.3 VDC
D	0 to 8 VDC (dependent upon RX IF LEVEL pot in RFU)

5. If all voltages are within range, the LNC unit is faulty.
6. If one or more voltage are incorrect, refer to the RFU troubleshooting in Section 2.0.

4.2 M&C INTERFACE

Serial Port Connector Pin Assignments
Connector: J5
Connector Type: MS3114E12-10
Mating connector: MS3116E12-10

Pin	Signal Name
A	RS-232 Tx
B	RS-232 Rx
C	Signal Common
D	RS-485 Tx+
E	RS-485 Tx-
F	RS-485 Rx+
G	RS-485 Rx-
H	Baud Select
J	+5 VDC (for optional handheld terminal)
K	+5 VDC Return

Summary Alarm Connector Pin Assignments
Connector: J4
Connector Type: MS3114E8-4
Mating connector: MS3116E8-4

Pin	Signal Name
A	TX Alarm (normally open)
B	Common
C	RX Alarm (normally open)
D	TX Disable (Connect to common for TX Disable)

RS-232 Interface
The radio contains an RS-232 data communications equipment (DCE) interface on J5, the serial port. This interface allows the use of an ASCII terminal or computer serial port to control a single radio.

This port can run simultaneously with either the RS-485 Party Line or NPI interface. This ensures that address and data rate parameters can always be set.

ASCII character strings fed to the radio are echoed and interpreted as received. All carriage return characters are echoed as a carriage return/line feed sequence. All characters are transmitted as 7 bit ASCII regardless of the data format chosen. The 8th bit of input characters is ignored.

Either interactive terminal or NPI interface modes can be selected with the "NPI" command. If an "NPI=OFF" command is entered, the RS-232 port operates in the interactive terminal mode and the RS-485 port operates in the multidrop party line mode. If an "NPI=ON" command is entered, the RS-232 port operates in the NPI mode (minus the packet formatting) and the RS-485 port also operates in the NPI mode (with packet formatting).

Data Interface

Type	DCE, Full duplex
Levels	RS-232
Data Rates	9.6 kbps, 1 stop bit, 8 data bits, no parity
	1.2 kbps, 1 stop bit, 7 data bits, odd parity

The data rate is selected by use of the "Baud Select" line, pin H of J5. When the pin is open, the data rate is 1200 bps. When the pin is shorted to ground, the data rate is 9600 bps.

NOTE: The radio will generate odd parity when 1200 bps is selected and no parity when 9600 bps is selected. It will ignore incoming parity in all cases.

RS-485 Multidrop Party Line Operation

The RS-485 four wire addressable interface can be used for the "party-line" applications in which up to eight M&C units and 1+1 Protection Switches are operated in parallel on the same cable from a single terminal or computer.

This interface operates similar to an RS-232 full duplex connection. A master terminal issues a "SAD *X*" command, in which *X* is a number from 0 to 7. If this number matches the radio setting, the RS-485 line drivers and receivers in the radio are turned on. They remain on until a "SAD *Y*" command is given, in which $Y \neq X$.

Data Interface

Type	Full duplex, 4 wire (plus ground) interface
Levels	Balanced V.11/RS-485 levels, nominal 0 volts for low, +5 volts for high
Data Rates	9.6 kbps, 1 stop bit, 8 data bits, no parity
	1.2 kbps, 1 stop bit, 7 data bits, odd parity

The data rate is selected by use of the "Baud Select" line, pin H of J5. When the pin is open, the data rate is 1200 bps. When the pin is shorted to ground, the data rate is 9600 bps.

NOTE: The radio will generate odd parity when 1200 bps is selected and no parity when 9600 bps is selected. It will ignore incoming parity in all cases.

Getting Started

- Verify that the AC power to the RF radio power supply is disconnected or turned off.
- Ensure that the M&C to terminal interconnecting cable (customer provided) is properly installed.
- Turn the terminal power on/off switch to the ON position and allow the computer terminal to complete its self test.
- Apply power to the RF radio driver unit.
- The following startup screen will appear for RS-232 only. For RS-485 operation, the set address <SAD> command must be entered to "talk" to the unit.

```
+----------------------------+
|    SSE Technologies, INC.  |
|    ASAT M&C System         |
+----------------------------+

Software Revision B  -  Jan 21 1994
Initializing.................

+----------------------------------------------------------------+
|                     ASAT SYSTEM STATUS                         |
|                                                                |
+------------------------------------------+---------------------+
|                                          | Summary Status  OK  |
+------------------------------------------+---------------------+
|Transmitter:     Ku-Band (All-Band)       |                     |
|Synth  Freq:      3195.000 MHz            |Receive Level    OK  |
|Uplink Freq:     14000.000 MHz            |FFL Lock         OK  |
|IF     Freq:        70.000 MHz            |FFL LEVEL        OK  |
|Output Mon :          2.80 VDC            |FAL/SYN #1       OK  |
|                                          |FAL/SYN #2       OK  |
|Attenuator :            0 dB              |HFLO #1          OK  |
|                                          |HFLO #2          OK  |
|Dual Synth Configured(separate up/dnlink) |Tx PWR           OK  |
|                                          |+15VDC           OK  |
|Receiver:        Ku-Band (All-Band)       |+10VDC           OK  |
|Synth Freq :      3007.500 MHz            |+5VDC            OK  |
|Dnlink Freq:     10950.000 MHz            |-5VDC            OK  |
|                                          |TWT              OK  |
|                                          |TWT Status       OK  |
+------------------------------------------+---------------------+

Enter Command>
```

- The radio is now ready for full operation.

M&C Commands

Valid commands are shown in this section. The examples listed below demonstrate how the various commands work.

ATTEN: This is an option used with power uplink control only.
Enter Command>**A<CR>**
Enter value in dB (currently = 1 dB):
Enter a value between 1 and 31 (dB).

BEAMON: This command is used with TWT units only. This command turns the TWT beam on.
Enter Command>**BEAMON<CR>**
TWT beam is ENABLED
The TWT beam (high voltage) is ON.

BEAMOFF: This command is used with TWT units only. This command turns the TWT beam off.
Enter Command>**BEAMON<CR>**
TWT beam is DISABLED
The TWT beam (high voltage) is ON.

CSA: This command sets the SAD address for the RS-485 link. Addresses can be set from 0 to 7.
Enter Command>**CSA 1<CR>**
SAD address = 1
The SAD address is set to 1
Enter Command>**CSA<CR>**
SAD address=1
Enter Command>**CSA<CR>**
Enter SAD address (0..7):**<CR>**
No Change
SAD address = 1
The SAD address was previously set to 1.

FSYNTH: This command changes the synthesizer frequencies.
Enter Command>**FSYNTH<CR>** or **FS<CR>**
Which Synthesizer: Uplink or Downlink?
Enter **U <CR>** for Uplink (TX) Synthesizer or **D <CR>** for Downlink (RX) Synthesizer
Enter value in kHz currently =3195000 kHz):
Enter a valid frequency.

HELP (This command displays the **HELP** screen.)
Enter Command>**H<CR>** or **HELP<CR>**

```
AVAILABLE COMMANDS (UPPER or lower case, followed by <ENTER> ):

ATTEN    A  <dB>        - Program Transmit Attenuator
BEAMON                  - Turns TWT beam ON
BEAMOFF                 - Turns TWT beam OFF
CSA #                   - Change SAD address of RS485 port
DEBUG   DB              - Toggle Debug Commands on/off
SYNTH  FS <freq>       - Program synthesizer frequency
HELP    H, ?            - Display this menu
PTXOFF                  - Disable Transmitter output at Power-on
PTXON                   - Enable Transmitter output at Power-on
PWR                     - Display Output power level
REV                     - Display Software Revision and Date
RXF     FD <freq>       - Program downlink frequency
SAD #                   - Sets Rs485 address
SN                      - Display serial # of prom in radio
STAT    S               - Display system status
TITLE                   - Enter Optional Title for status screen
TXF     FU <freq>       - Program uplink frequency
TXON                    - Enable Transmitter output
TXOFF                   - Disable Transmitter output
TWTRES                  - Reset TWT fault
^W                      - Report System Status in TERSE format
```

The TWT related commands are displayed only for radios which drive a TWT.

NPI: This command selects NPI mode state. If the value is "ON", the NPI interface is selected for the RS-232 and RS-485 ports. If the value is "OFF" the interactive terminal mode is selected.

```
Enter Command>NPI=OFF<CR>
NPI=OFF<CR>
```

The RS-232 interactive terminal mode and party line RS-485 interface is selected.

PTXOFF: This command disables transmitter output at power ON.

```
Enter Command>PTXOFF<CR>
Transmitter state at Power-on is DISABLED
```

The transmitter will wait for a **TXON** command before turning on.

PTXON: This command enables transmitter output at power-ON.

```
Enter Command>PTXON<CR>
Transmitter state at Power-on is ENABLED
```

The transmitter will not wait for a **TXON** command before turning on.

PWR: This command displays the current detector voltage and associated dBm reading (if defined).

```
Enter Command>PWR<CR>
Output power in V: 1.500  dBm:   25.00
```

The current transmitter output power is displayed. The dBm reading is not displayed if the power table is not defined.

REV: This command displays software revision.
`Enter Command>`**`REV<CR>`**
`351042709001 Rev B Jan 21, 1994`

RXF: This command changes downlink frequency.
`Enter Command>`**`RXF<CR>`**
`Enter value in kHz (currently = 11700000 kHz)`
Enter a valid frequency.

SN: This command displays the system serial number.
`Enter Command>`**`SN<CR>`**
`SN=XXXXX`
`Enter Command>`

STAT: This command displays system status.
`Enter Command>`**`S<CR>`** or **`STAT<CR>`**
The status screen shown previously is displayed.

TITLE: This command is used to enter a custom title.
`Enter Command>`**`TITLE<CR>`**
`Enter optional title string (64 characters max.) or <ENTER> to clear.`
The custom title appears on the second title line at the top of the status screen.

TXF: This command changes the uplink frequency
`Enter Command>`**`TXF<CR>`**
`Enter value in kHz (currently = 14000000 kHz):`
Enter a valid frequency.

TXON: This command is used to turn the transmitter on.
`Enter Command>`**`TXON<CR>`**
`Transmitter is ENABLED`

TXOFF: This command is used to turn the transmitter off.
`Enter Command>`**`TXOFF<CR>`**
`Transmitter is DISABLED`

TWTRES: This command is used to reset the TWT when recovering from a fault condition. If the TWT beam (HV) is set on, this command turns the beam off and then turns it back on again. It is valid only used with systems that include a TWT.
`Enter Command>`**`TWTRES<CR>`**
`TWT RESET`

^W: This command reports system status in TERSE format.
`Enter Command>`**`<CTL-W>`** (The Control-W keys are pressed simultaneously.)
`14000000 11700000 00A0 00E9 00000000`

The string format is shown below.

Start	Uplink	SP	Dwnlnk	SP	SYN1	SP	SYN2	SP	Alarms	End

Start Default is ASCII STX (02 Hex). This character can be changed with the `CONFIG` command.

Uplink 8 decimal digit uplink frequency in kHz

SP ASCII space (20 Hex)

Dwnlnk 8 decimal digit downlink frequency in kHz

SP ASCII space (20 Hex)

SYN1 4 hexadecimal digits of synthesizer bits.

SP ASCII space (20 Hex)

SYN2 4 hexadecimal digits of synthesizer bits.

SP ASCII space (20 Hex)

Alarms 32 bits of alarm & status represented by 8 hexadecimal digits. A 0 indicates no alarm, a 1 indicates an alarm

Bit 00 Summary Status	Least significant bit, last digit
Bit 01 RX IF Level	
Bit 02 FFL/PLO Lock	
Bit 03 FFL/PLO Level	
Bit 04 FAL/SYN Lock #1	Least significant bit, next digit
Bit 05 FAL/SYN Lock #2	
Bit 06 HFLO Level #1	
Bit 07 HFLO Level #2	
Bit 08 TX Power	Least significant bit, next digit
Bit 09 +15 VDC	
Bit 10 +10 VDC	
Bit 11 +5 VDC	
Bit 12 -5 VDC	Least significant bit, next digit
Bit 13 TWT Fault	
Bit 14 TWT Standby	
Bit 15 TWT Beam Off	(High if beam off)

Bits 16 through 31 are not used, all 0.

Stop Default is ASCII (ETX) (03 Hex). This character can be changed with the `CONFIG` command.

Power Restart Operation

The M&C is equipped with EEPROM that saves the parameter configuration and data during a power outage.

If set for `PTXON` operation, the radio is returned to the operating status in effect prior to the power outage.

In the `PTXOFF` operating mode, the radio is returned to the operating status in effect prior to the power outage, but the radio assumes a standby status (the transmitter is turned OFF). This permits the operator to verify operating parameters. The transmitter will then have to be enabled using the `TXON` command.

Alarms

The M&C assembly permits system alarm status to be remotely monitored at the computer terminal. An alarm indicates that the monitored function is not operating within defined specifications.

Summary Alarm	One or more alarms present
Receive Level	Failure in receive amplifier chain resulting in low or no receive IF output. This alarm may be caused by the setting of the driver RX level.
FFL/PLO LOCK	Phase lock Oscillator failure
FAL/SYN #1	TX Synthesizer Failure
FAL/SYN #2	RX Low Freq Synthesizer failure or RX High Freq Synthesizer failure
TX POWER	Transmit power output low or missing. This may be caused by a radio failure or lack of an input signal.
+15VDC	+15 volt power supply failure
+10VDC	+10 volt power supply failure
+5VDC	+5 volt power supply failure
-5VDC	-5 volt power supply failure
TWT FAULT	Fault or failure in the TWT. This alarm is only generated if a TWT has been provided as part of the system.
TWT STANDBY	The TWT is in the standby mode.
TWT BEAM	The TWT beam (high voltage) supply is off. This condition occurs when the beam has not been turned on or a fault condition has been detected.

RX_FREQ[=freq](RFR)
This command gets[sets] the receive RF frequency. Acceptable values must be in range for the current RF band and will be rounded to the closest RF frequency step.

The frequency set process controls the synthesizer so that the specified frequency will be down converted to 70 or 140 MHz. If the radio contains only one synthesizer, this operation will also change the transmit frequency. The desired frequency can be achieved more easily by issuing the RF_SET_SYN_1 or RF_SET_SYN_2 command.

RX_FREQ=3725.0 sets the receive frequency to 3.725 GHz

Acceptable values are shown below:

RF Band	Description	Minimum RX Frequency (MHz)	Maximum RX Frequency (MHz)	Step Size (MHz)
CBAND	C-band	3657.5	4217.5	2.5
NORAM	Ku-band NORAM/ ORION (N. Am)	11700.0	12220.0	1.0
INTELSAT HI	INTELSAT High band/ ORION (Eu Tr 1-8)	11450.0	11700.0	1.0
INTELSAT LO	INTELSAT Low band	10950.0	11200.0	1.0
EUTELSAT	Eutelsat/ ORION (Eu Tr 9-17)	12250.0	12750.0	1.0
OPTUS	Optus (Aussat)	12250.0	12750.0	1.0
PANAMSAT	Panamsat	11450.0	11950.0	1.0
KUALL	Ku-All band	10950.0	12750.0	1.0
XBAND	X-band	7250.0	7750.0	0.5
EXTC	Extended C-Band	3625.0	4200.0	2.5
INSAT	INSAT C-Band	4500.0	4800.0	2.5

RX_MIN_FREQ(RMF)
This command gets the minimum receive RF frequency in MHz of the radio.

REQUEST:
RX_MIN_FREQ
RESPONSE:
RX_MIN_FREQ=3625.0 The minimum receive frequency is 3.625 GHz.

RX_MAX_FREQ(RMAF)
This command gets the maximum receive RF frequency in MHz of the radio.

REQUEST:
RX_MAX_FREQ
RESPONSE:
RX_MAX_FREQ=4200.0 The maximum receive frequency is 4.200 GHz.

RX_OFFSET_FREQ(ROF)
This command gets the receive offset frequency in MHz. This frequency is used in conversion of the synthesizer to the RF frequency.

REQUEST:
RX_OFFSET_FREQ
RESPONSE:
RX_OFFSET_FREQ=1250.0
The receive offset frequency is 1.250 GHz.

RX_STEP_SIZE(RSS)
This command gets the receive RF step size in MHz of the radio.

REQUEST:
RX_STEP_SIZE
RESPONSE:
RX_STEP_SIZE=1.0 The receive step size is 1.0 MHz.

SERIAL_NUMBER(SN)
This command gets the serial number of the radio.

REQUEST:
SERIAL_NUMBER
RESPONSE:
SERIAL_NUMBER=6789 The radio serial number is 6789.

SYNTH(STH)
This command gets[sets] the number of synthesizers (1 or 2) in the radio.

SYNTH=1 The radio has 1 synthesizer.
SYNTH=2 The radio has 2 synthesizers.

TWT_RESET=ON(TR=ON)
This command resets the TWT beam supply. It is implemented only if a TWT amplifier is connected to the driver. If the beam has been previously commanded ON, the beam will be turned OFF and then ON.

TWT_RESET=ON	Reset cycle generated for the TWT beam supply

TX[=state]
This command gets[sets] the transmitter state on or off. Acceptable values are ON and OFF.

TX=ON	turns the transmitter on and
TX=OFF	turns the transmitter off.

If major alarms prevent the transmitter from turning on, the following response shall be seen:

TX=OFF_DUE_TO_ALARMS

If the transmitter is still in a power on delay (warm-up) cycle, the following response shall be seen:

TX=OFF_DUE_TO_POD

The turn on request will be honored as soon as alarm or delay conditions are cleared.

TX_ATTEN_VALUE[=dB](TAV)
This command gets[sets] the optional transmit RF attenuator value. Acceptable values are 0 to 31 dB in 1 dB steps. Commanded values are rounded to the closest available attenuator step. If the attenuator is not installed, an "UNKNOWN_COMMAND" message is generated.

REQUEST:

TX_ATTEN_VALUE	get the current transmit attenuation

RESPONSE:

TX_ATTEN_VALUE=7	the current transmit attenuation is 7 dB.

REQUEST:

TX_ATTEN_VALUE=5	sets the transmit attenuation to 5 dB.

RESPONSE:

TX_ATTEN_VALUE=5	the current transmit attenuation is set to 5 dB.

REQUEST:

TX_ATTEN_VALUE=65	try to set the transmit attenuation out of range

RESPONSE:

TX_ATTEN_VALUE=INVALID_PARAMETER

TX_ATTEN(TA)
This command gets the connection status of the optional transmit RF attenuator. Acceptable values are ON and OFF.

REQUEST:
TX
RESPONSE:
TX_ATTEN=ON An attenuator is connected and
TX_ATTEN=OFF An attenuator is not connected.

TX_FREQ[=freq](TFR)
This command gets[sets] the transmit RF frequency. Acceptable values must be in range for the current RF band and will be rounded to the closest RF frequency step.

The frequency set process will control the synthesizer so that the specified frequency will be produced when the transmit IF is set to 70 or 140 MHz. If the radio contains only one synthesizer, this operation will also change the receive frequency. In many cases the desired control can be achieved by issuing the RF_SET_SYN_1 command.

RX_FREQ=6400.0 sets the receive frequency to 6.400 GHz

Acceptable values are shown below:

RF Band	Description	Minimum TX Frequency (MHz)	Maximum TX Frequency (MHz)	Step Size (MHz)
CBAND	C-band	5882.5	6442.5	2.5
NORAM	Ku-band NORAM/ ORION (N. Am)	14000.0	14250.0	1.0
INTELSAT HI	INTELSAT High band/ ORION Eu (Tr 1-8)	14250.0	14500.0	1.0
INTELSAT LO	INTELSAT Low band	14000.0	14250.0	1.0
EUTELSAT	Eutelsat/ ORION (Eu (Tr 9-17)	14000.0	14250.0	1.0
OPTUS	Optus (Aussat)	14000.0	14500.0	1.0
PANAMSAT	Panamsat	14000.0	14500.0	1.0
KUALL	Ku-All band	14000.0	14500.0	1.0
XBAND	X-band	7900.0	8400.0	0.5
EXTC	Extended C-Band	5850.0	6425.0	2.5
INSAT	INSAT C-Band	6725.0	7025.0	2.5

MONITOR and CONTROL SPECIFICATIONS

Customer Interface	RS-232/RS-485 10 pin, MS Female connector
Serial Data	
RS-232	
Data rate	1200 bps, 7 bits, odd parity
	9600 bps, 8 bits, no parity
RS-485 "Multidrop Party Line"	
Data Rate	1200 bps, 7 bits, odd parity
	9600 bps, 8 bits, no parity
Interface	4 wire, full duplex
Address	0 to 7
RS-485 Network Packet Interface (NPI)	
Date Rare	75 to 19,200 bps, 8 bits, no parity
Interface	2 wire, half duplex
Address	1 to 255
M&C Board	
Processor type	80C51
EPROM	256 kbytes
RAM	32 kbytes
EEPROM	8 kbytes
Memory retention, unpowered	10 years minimum

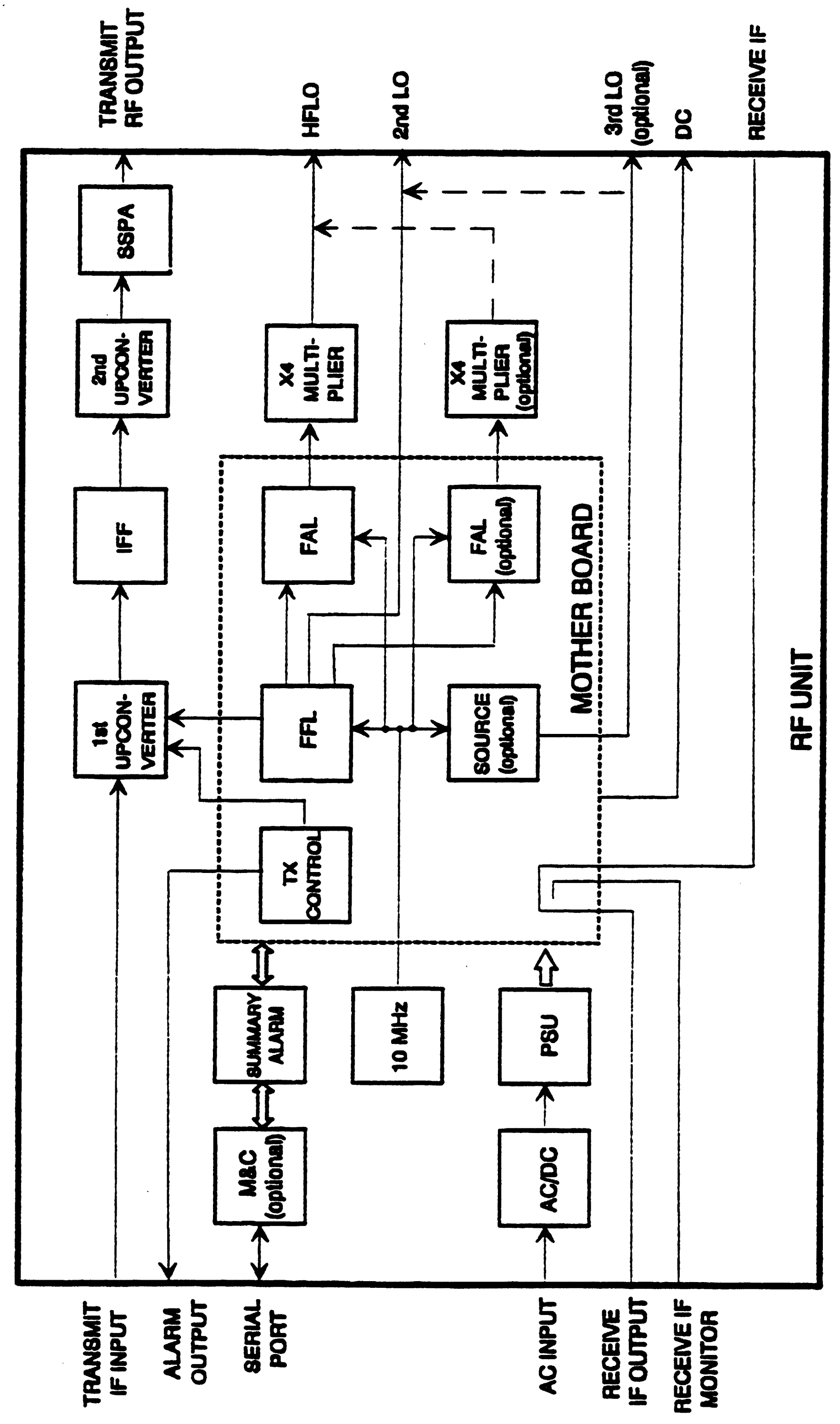


FIGURE 2.2 ASAT S1214 RFU FUNCTIONAL BLOCK DIAGRAM

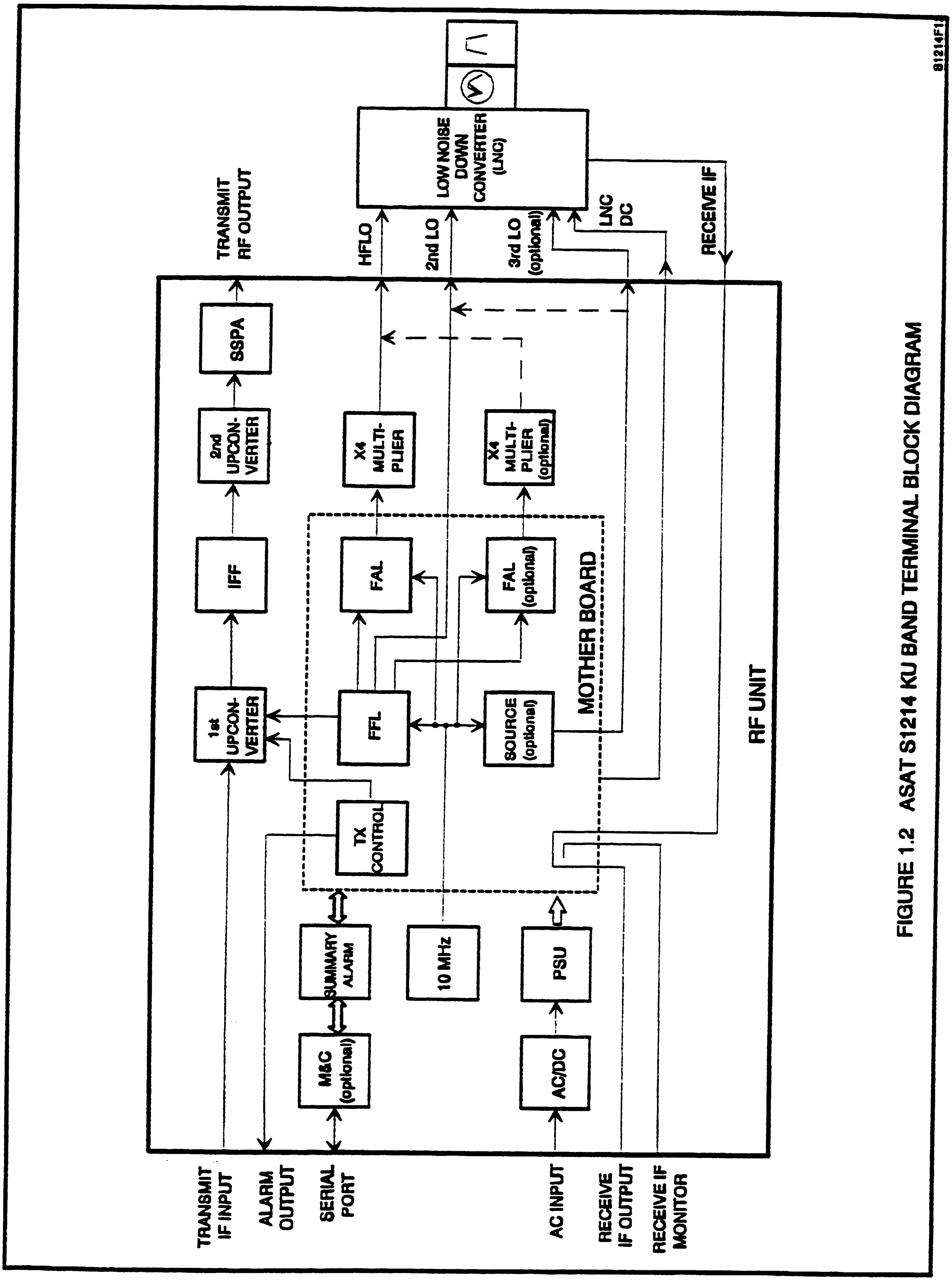
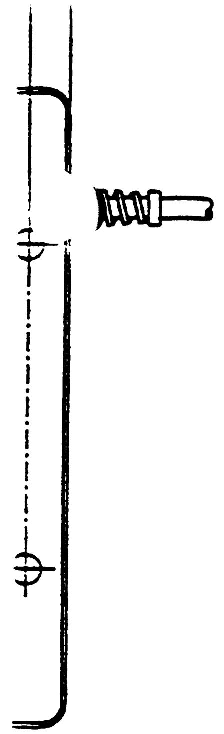
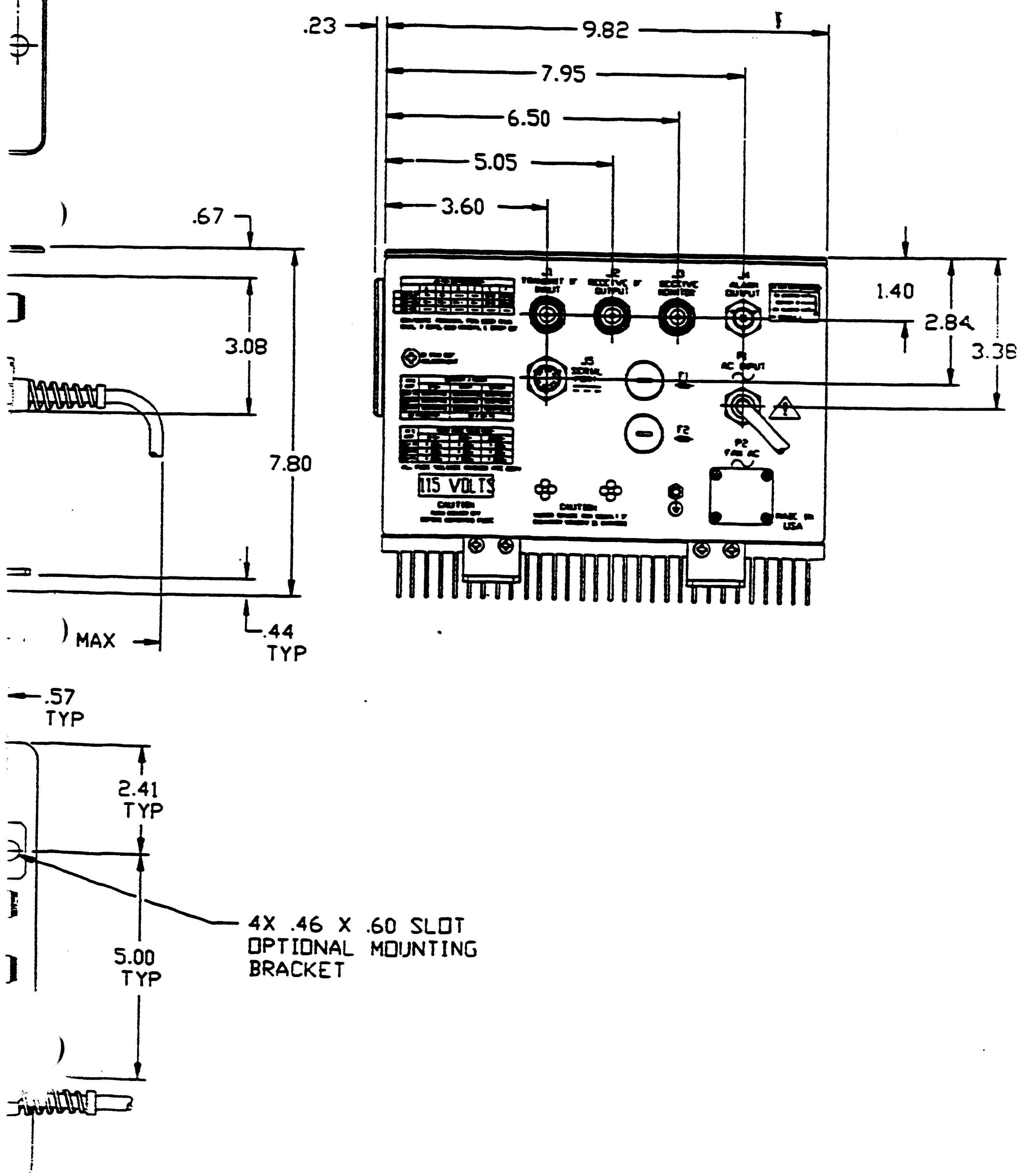
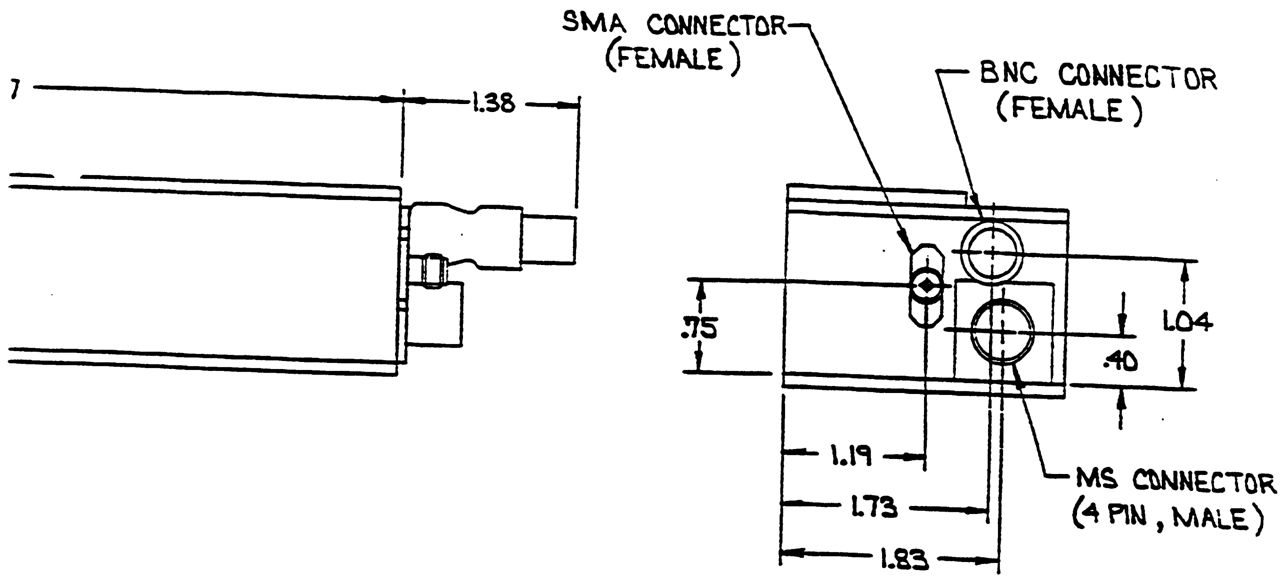


FIGURE 1.2 ASAT S1214 KU BAND TERMINAL BLOCK DIAGRAM

J4	MS3114E8-4 RECPT	MS3116F8-4 PLUG
J5	MS3114E10-6 RECPT	MS3116F10-6 PLUG
J6	MS3114E8-4 RECPT	MS3116F8-4 PLUG
J7	TYPE-N RECPT	TYPE-N PLUG
J8	TYPE-SMA RECPT	TYPE-SMA PLUG
J9	TYPE-SMA RECPT	TYPE-SMA PLUG
J10	TYPE-SMA RECPT	TYPE-SMA PLUG
RF OUTPUT	WR-75 COVER FLANGE WITH O-RING	WR-75 COVER FLANGE W/O O-RING



NTING DIMENSIONS
C)

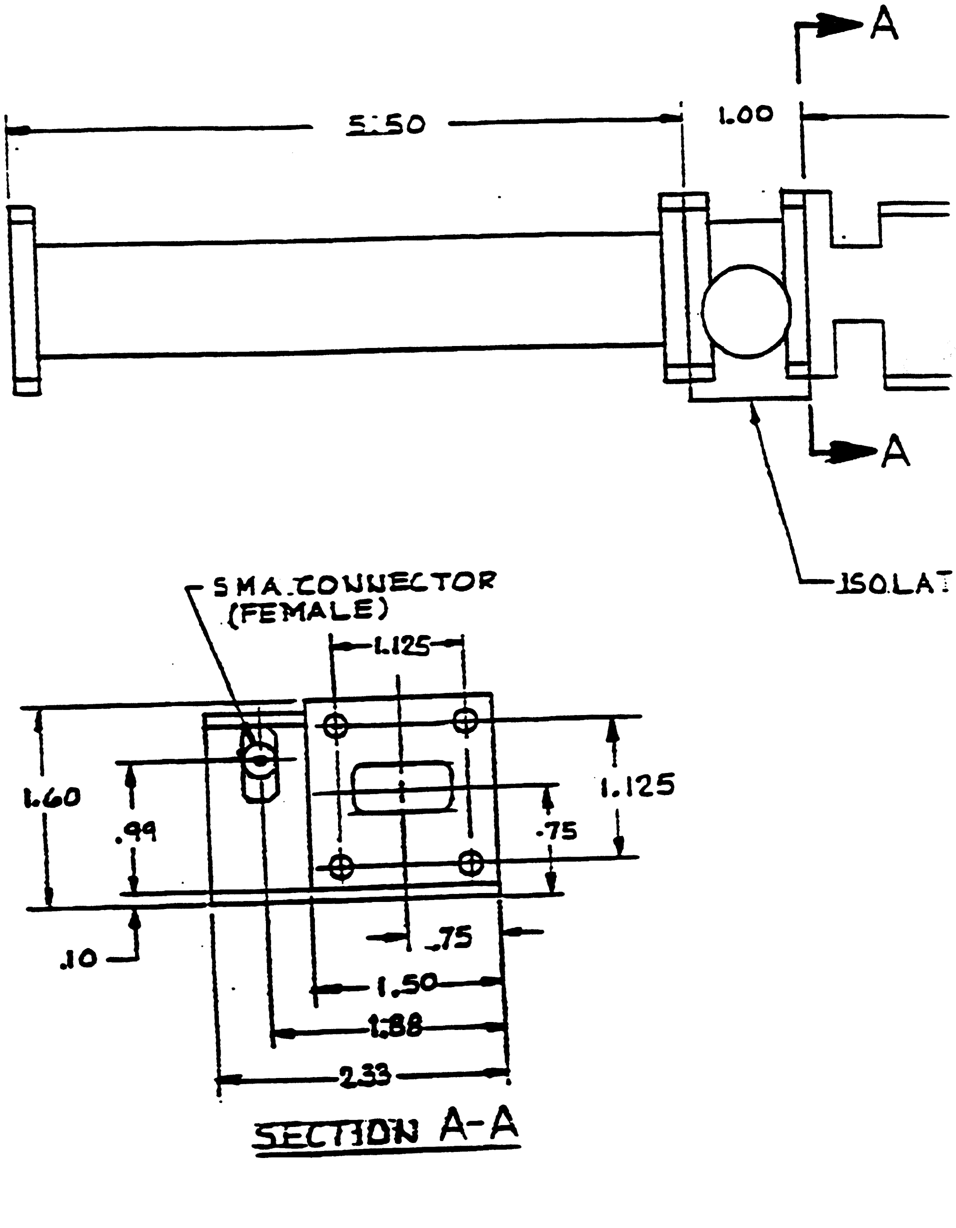

A
5.50
1.00
A
ISOLAT
SMA CONNECTOR
(FEMALE)
1.125
1.60
.99
1.125
.75
.10
.75
1.50
1.88
2.33
SECTION A-A

FIGURE 3.2 K

1.0 INTRODUCTION

1.1 Purpose

This manual contains installation, operation, theory and maintenance information for the following Skydata Ku-Band Satellite Electronics Equipment:

- IF Electronics Assembly Models 2451ASU, 2451ASE and 2451AST
- IF Electronics Assembly Models 2452ASU, 2452ASE and 2452AST
- RF Feed Assembly Models 2401ASU, 2401ASE and 2401AST.

These are referred to as "IF units" and "RF units" in this manual. Table 1.1-1 summarizes characteristics of these units.

Table 1.1-1. Unit Characteristics

Transmit and Receive Frequencies	**TX: 14-14.5 GHz RX: 11.7-12.2 GHz**	**TX: 14-14.5 GHz RX: 12.25-12.75 GHz**	**TX:14-14.5 GHz RX: 10.95-11.2 GHz**
Application	Domestic US	Europe	Intelsat "Lo" Ku
IF Unit, 70 MHz IF Interface	2452ASU	2452ASE	2452AST
IF Unit, 140 MHz IF Interface	2451ASU	2451ASE	2451AST
RF Unit, 2 Watt	2401ASU	2401ASE	2401AST
RF Unit, 3 Watt	2401CSU	2401CSE	2401CST

RF Unit Options: Model 2401 RF Unit is available with two different output power ratings, as shown above, designated by "A" or "C" in the model number. In addition, units are available with separate WR-75 waveguide ports for transmit and receive (designated by "-75" suffix on the model number. Units are also available with an SMA connector for the output of the internal Solid State Power Amplifier, and another SMA connector for the input to the transmit waveguide. This option is designated by a suffix "-F." Both options (e.g. "Model 2401ASU-75-F") may be installed. See Section 2.3.

1.2 Equipment Description

Together, the RF Feed Assembly and the IF Electronics Assembly provide transmit and receive electronics for a VSAT (Very Small Aperture Terminal) satellite earth station. These units may also be used as RF components in larger systems. The units are enclosed in weatherproof housings for outdoor mounting directly on the antenna. Model 2401A RF Feed Assembly mounts to the antenna feed, and accepts Ku-band receive signals, amplifies and downconverts the signals to L band (950 to 1450 MHz). Transmit signals at 1300 MHz are upconverted to 14.0 to 14.5 GHz and amplified for transmission to the satellite. The RF Feed Assembly is connected to the IF Electronics Assembly at the antenna rear. This assembly provides up- and down-conversion of L-band signals to lower IF frequencies suitable for connection to indoor equipment.

1.3 Specifications

The RF and IF units are shown in Figure 1.3-1. Figure 1.3-2 shows the optional configuration of the RF Feed Assembly with separate transmit and receive waveguide ports. Specifications for combined RF/IF system performance are in Table 1.3-1. Specifications for RF units are in Table 1.3-2. Specifications for IF units are in Table 1.3-3.

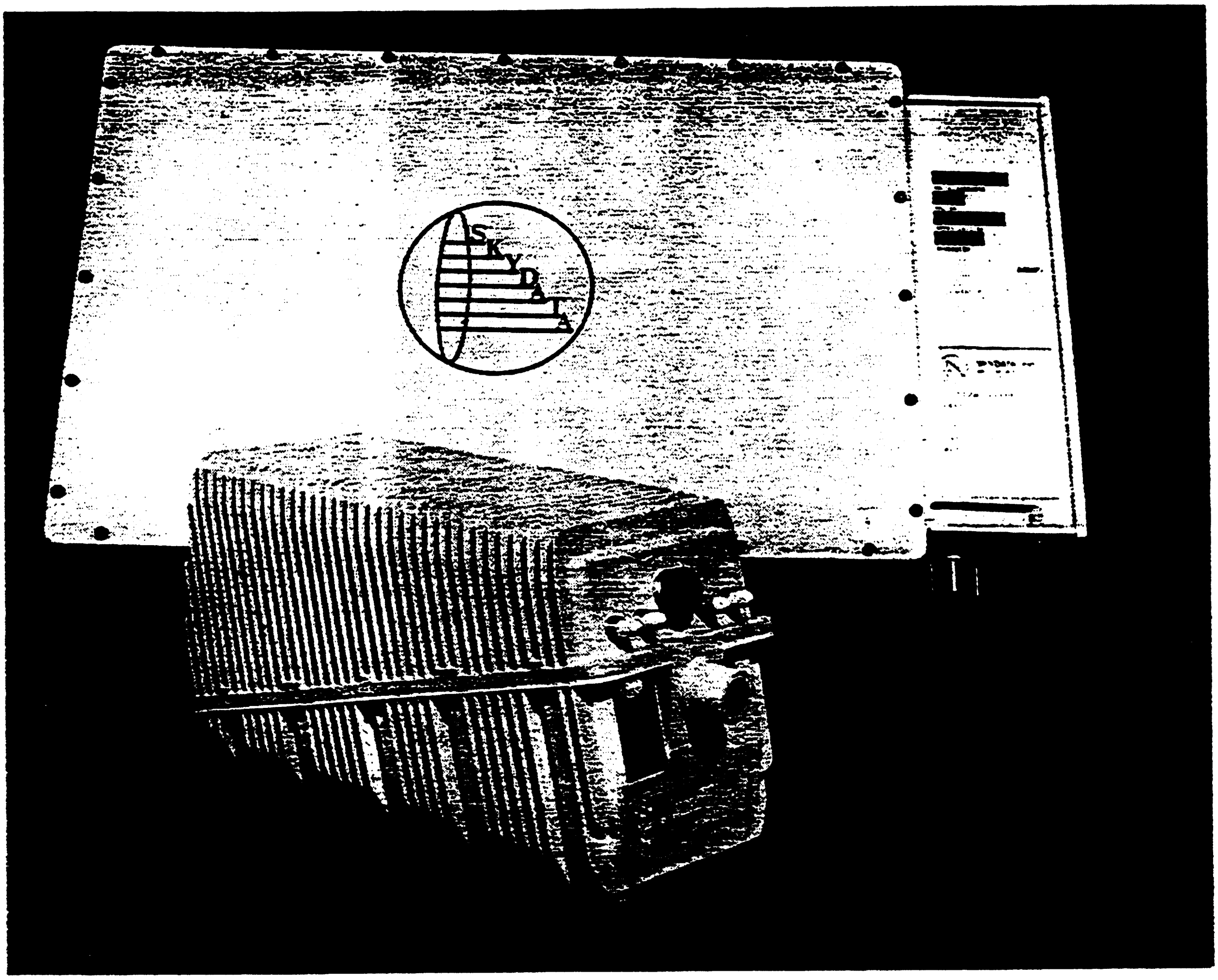


Figure 1.3-1. RF Feed Assembly and IF Electronics Assembly

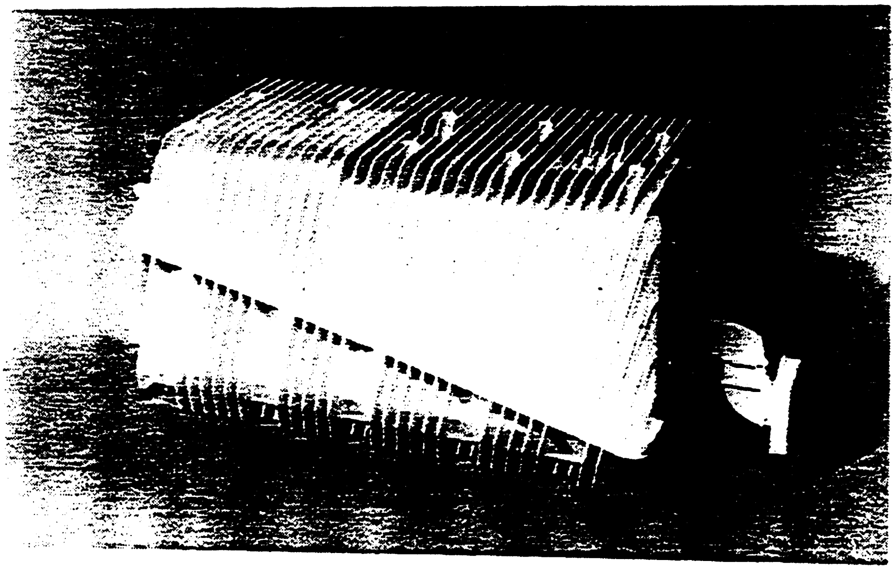


Figure 1.3-2. Model 2401ASU-75-F RF Feed Assembly

Table 1.3-1. Specifications, System Performance

Parameter	Specification
RF Frequency Range, Transmit:	14.0 to 14.5 GHz
RF Frequency Range, Receive:	11.7 to 12.2 GHz (ASU Models) 12.25 to 12.75 GHz (ASE Models) 10.95 to 11.2 GHz (AST Models)
<u>Using Model 2451A:</u>	
IF Frequency Range, Transmit:	140 ±10.0 MHz minimum
IF Frequency Range, Receive:	140 ±10.0 MHz minimum
<u>Using Model 2452A:</u>	
IF Frequency Range, Transmit:	70 ±27 MHz minimum
IF Frequency Range, Receive:	70 ±27 MHz minimum
Tuning:	1 MHz steps
Second Step, Transmit:	14.001 GHz
Second Step, Receive:	11.701 GHz (ASU) 12.251 GHz (ASE) 10.951 GHz (AST)
Transmit Power Output, at 1 dB Gain Compression at OMT Output Flange:	
Using Model 2401Axx:	2.5 W typical, 2.0 W minimum
Using Model 2401Cxx:	3.0 W minimum
Gain, Transmit:	65 +1.75 dB, -0.75 dB
Gain, Receive:	80 +10 dB, -0 dB
Gain Breakdown, Transmit:	
RF Unit:	45.5 +1 dB, -0 dB
IF Unit:	22.8 ±0.5 dB
Cable:	-3.3 ±0.25 dB
Gain Breakdown, Receive:	
RF Unit:	53 ±3 dB
IF Unit:	35.2 ±1.75 dB
Cable:	-3.2 ±0.25 dB
Gain Variation over 500 MHz at 1 dB Gain Compression, Transmit:	2 dB p-p

Table 1.3-1. Specifications, System Performance, Continued

Parameter	Specification
Gain Variation over 500 MHz at 1 dB Gain Compression, Receive:	5 dB p-p
<u>Using Model 2451A:</u> Gain Variation over 20 MHz at 1 dB Gain Compression, Transmit:	1.5 dB p-p
Gain Variation over 20 MHz at 1 dB Gain Compression, Receive:	1.5 dB p-p
<u>Using Model 2452A:</u> Gain Variation over 54 MHz at 1 dB Gain Compression, Transmit:	2.0 dB p-p
Gain Variation over 54 MHz at 1 dB Gain Compression, Receive:	2.0 dB p-p
Gain Stability, Constant Temperature, Transmit:	0.5 dB/24 hours
Gain Stability, Constant Temperature, Receive:	0.5 dB/24 hours
Gain Stability, -40 to +50° C, Transmit:	0.03 dB/° C.
Gain Stability, -40 to +50° C, Receive:	0.05 dB/° C.
VSWR, RF at OMT (Transmit & Receive):	1.5:1 or better
VSWR, IF at 50 Ohm port	1.5:1 or better
VSWR, TVRO Port (950-1450 MHz, 75 ohm):	2.0:1 or better
Load VSWR at OMT, Transmit:	2.0:1 at maximum power output, no damage or reduced life at any VSWR.
Load VSWR at OMT, Receive:	2.0:1
Residual AM (RMS) with respect to an Unmodulated CW Carrier 1 dB Output Backoff, Transmit:	-30 dBc

Table 1.3-1. Specifications, System Performance, Continued

Parameter	Specification
AM to PM Conversion (Maximum Phase Shift) when Carrier Increases from 1% to 100%, Transmit and Receive:	10°
E_b/N_o Degradation of Bit Error Rate, at 10^{-6} from Theory for a Ku-Band Looped System at 112 Kbps BPSK:	Less than 1.0 dB
Harmonic Output to 40 GHz, Transmit:	-50 dBc
Noise and Spurious, 2451A or 2452A, Transmit:	-50 dBc at Maximum Output
Noise and Spurious, 2451A or 2452A, Receive, at 140 or 70 MHz IF Port:	-60 dBm with NO input signal; -40 dBc with -107 dBm Input Signal at OMT
Receive IF Output 1 dB Compression Point:	+7 dBm
Noise Figure at 25° C., Transmit:	20 dB
Noise Figure at 25° C., Receive:	180° K at OMT Input Port
OMT Cross Polarization, TX to RX	30 dB minimum
<u>Environmental, Operating:</u>	
Temperature:	-40 to +50° C (Ambient)
Relative Humidity:	0% to 100% Condensing
Altitude:	Up to 6000 ft AMSL
Shock and Vibration:	As Normally Encountered at a Satellite Earth Station
Solar Load:	360 BTU/Hour/Ft^2

Table 1.3-1. Specifications, System Performance (Continued)

Parameter	Specification
Environmental, Non-Operating:	
Temperature:	-40 to +60° C.
Relative Humidity:	0 to 100% Condensing
Altitude:	Up to 40,000 Feet AMSL
Shock and Vibration:	As Normally Encountered During Shipment
Power Requirements:	
Input Voltage:	117 VAC ±10%, 47-63 Hz; for Model 2451/2452ASE, 230 VAC ±10%
Power Consumption:	150 W maximum

Table 1.3-2. RF Feed Assembly Specifications

Parameter	Specification
OMT, Transmit:	14 to 14.5 GHz, 2.5 W typical, 2.0 W minimum
OMT, Receive:	ASU: 11.7 to 12.2 GHz ASE: 12.25 to 12.75 GHz AST: 10.95 to 11.2 GHz
950 to 1450 MHz Output (Receive Gain):	-53 ± 3 dB gain, type SMA female
RX Reference In (2.5 to 2.8 GHz):	-3 to +5 dBm, type SMA female
4.23 to 4.40 GHz In (TX Reference):	-7 to +5 dBm, type SMA female
1.3 GHz In (Transmit)	-10 to -8 dBm (at -30 dBm IF input to IF unit), type SMA female
DC In	4 pin Multi Plug +10.5 ±0.5 Vdc -8.0 ±0.5 Vdc
Dimensions:	Height: 7.0 inches (178 mm), Width: 13.2 inches (336 mm), Depth: 5.1 inches (130 mm)
Weight:	15.0 lbs (6.8 kg)

Table 1.3-3. Specifications, IF Electronics Assembly with Cable

Parameter	Specification
950 to 1450 MHz Input/Output Gain (RX):	-3 dB, referenced to Rx IF input (from 2401), BNC female
Reference Output (RX) (2.5-2.8 GHz):	5 dBm ± 3 dB, SMA female
4.23 to 4.4 GHz Reference Output (TX):	+1 to +11 dBm, Type SMA female
1.3 GHz Output (TX):	-10 to -8 dBm (with -30 dBm IF input level), SMA female
Video Out:	950 to 1450 MHz, 3 dB below level of input from RF unit
Model 2451A:	
IF In:	140 MHz, -30 dBm, N Female; external reference option: 10 MHz at -3 to +3 dBm
IF Out:	140 MHz, 80 to 90 dB higher than RF input level, N Female
Model 2452A:	
IF In:	70 MHz, -30 dBm, N Female
IF Out:	70 MHz, 80 to 90 dB higher than RF input level, N Female
Maintenance Connector:	14 P Multi Socket
Monitor & Control (M&C) Connector:	9 P Multi Socket
DC Power to RF Feed Assembly:	4 P Multi Socket +11 ± 0.3 Vdc -8 ± 0.6 Vdc RF FAULT GND
AC Power	4 P Multi Plug, 117 Vac ±10%, 47 to 63 Hz or (Model 245xASE) 230 VAC ±10%, 47 to 63 Hz

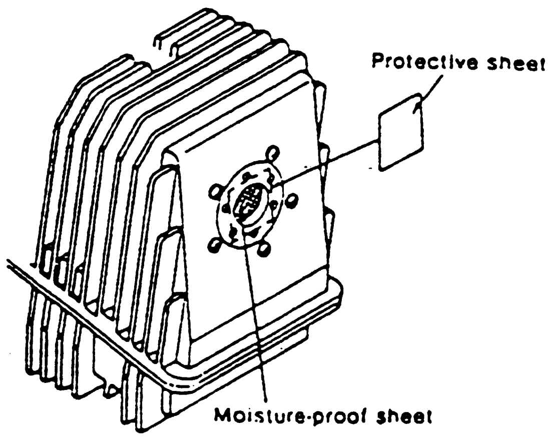
Table 1.3-3. Specifications, IF Electronics Assembly with Cable (Continued)

Parameter	Specification
Fuses:	125V 3A (F810) for 117 VAC units, 250V 1.5A (F810) for 230 VAC units 125V 2A (F803) 125V 600 mA (F804, 805)
Dimensions:	H: 17.04 inches (433 mm) W: 24.8 inches (630 mm) D: 6.54 inches (166 mm)
Weight:	2452A: 47.5 lbs (21.6 kg) 2451A: 46.2 lbs (21 kg)

Section 2

INSTALLATION

2.2.1 Feed Assembly Mounting



Standard unit: The circular waveguide opening of the RF Feed Assembly has a protective sheet to prevent damage to the inner sealing window. Before attaching the feedhorn to the RF unit, remove the protective sheet. Once the protective sheet is removed, DO NOT TOUCH THE SEALING WINDOW.

The RF unit is designed for mounting in a saddle that permits rotation around the waveguide axis to adjust polarization. For installation details, refer to Figure 2.2.1-2 and the antenna installation manual. Dimensions of the RF unit are shown in Figure 2.2.1-1. Mounting Procedure:

1. With the feed installed on the RF unit, place the unit in the saddle at the antenna focus (offset antennas), with the feed pointed toward the dish. For other antennas, refer to the manufacturer's instructions for mounting.

2. Install mounting clips to hold the unit in place, and install the screws that hold the clips. Leave screws loose to permit later rotation of the unit for polarization adjustment.

Dual Waveguide (*-75) units: See Figure 2.2.1-3. This unit mounts using the tapped holes in the waveguide support plate; it must also be supported by the rear circular protrusion.

2.2.2 Installation of the IF Unit

The IF Unit typically mounts at the rear of the antenna, using four bolts. Overall and mounting dimensions of the unit are shown in Figure 2.2.2-1.

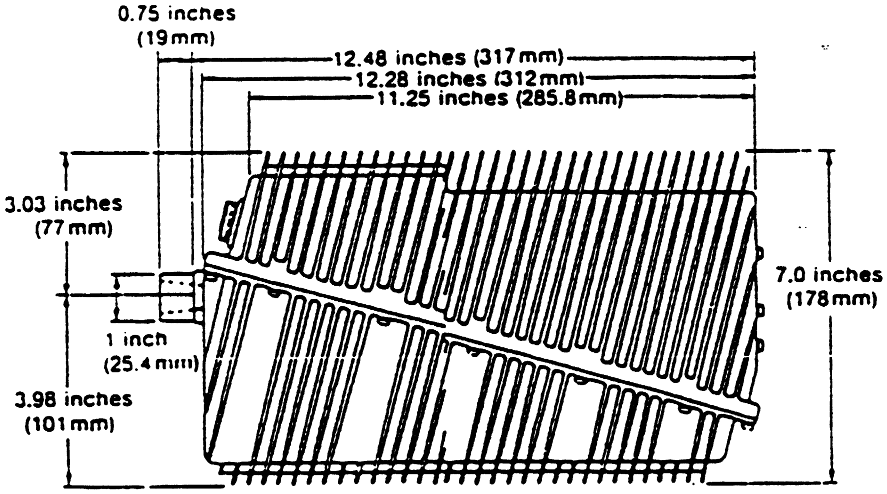


Figure 2.2.1-1. RF Feed Assembly Dimensions

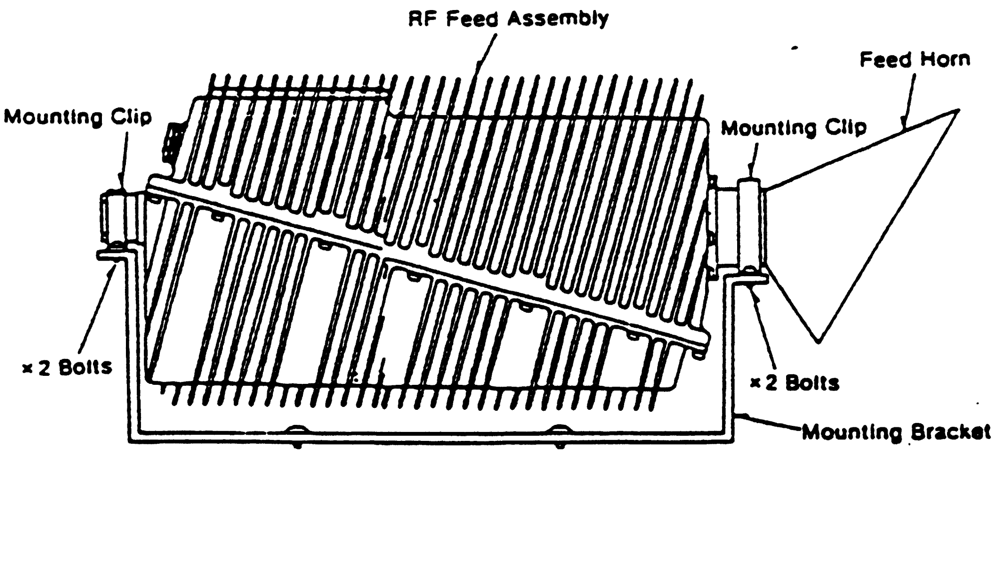


Figure 2.2.1-2. Installation of the RF Feed Assembly

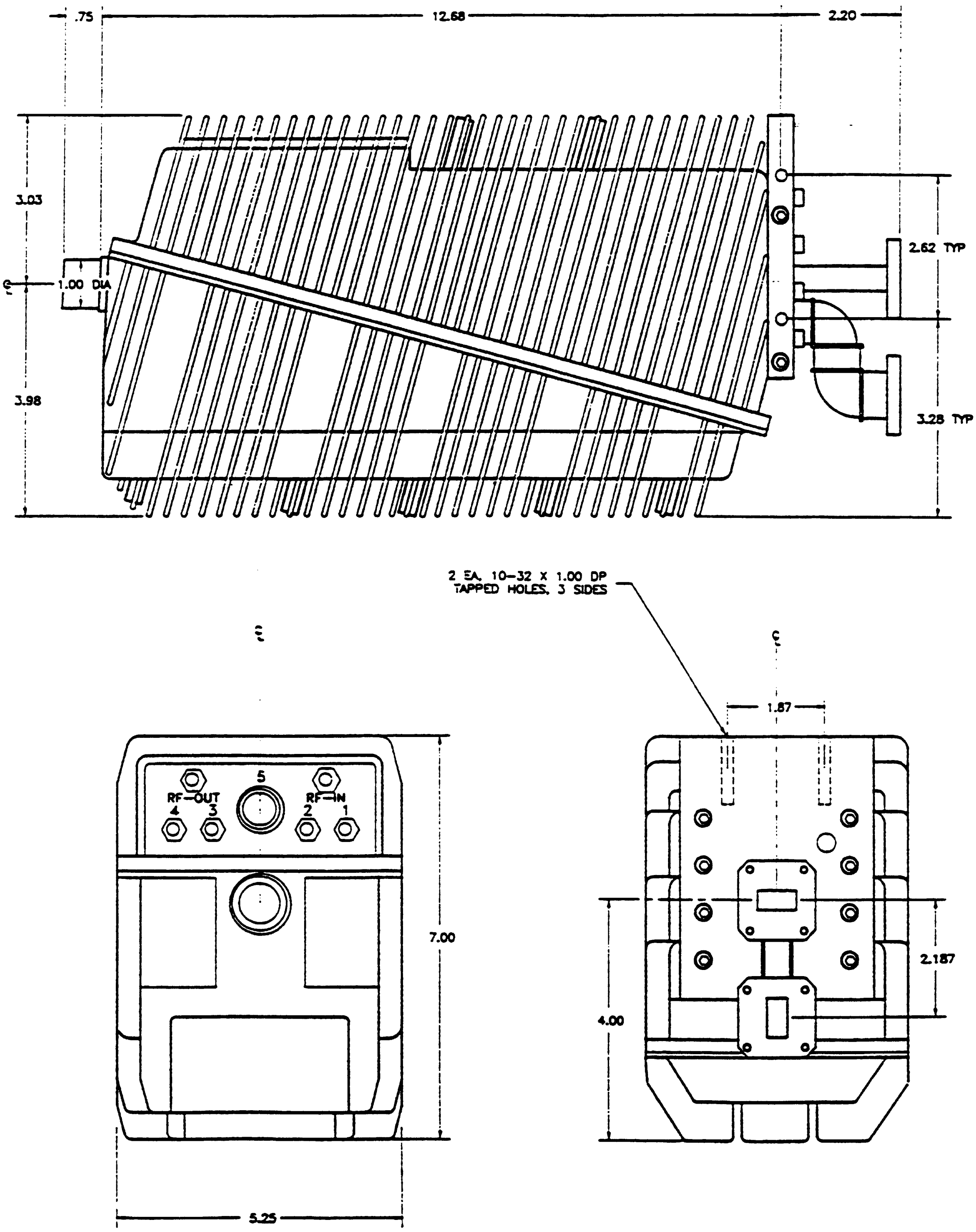


Figure 2.2.1-3. Mounting Dimensions, "-75" Series RF Feed Assembly

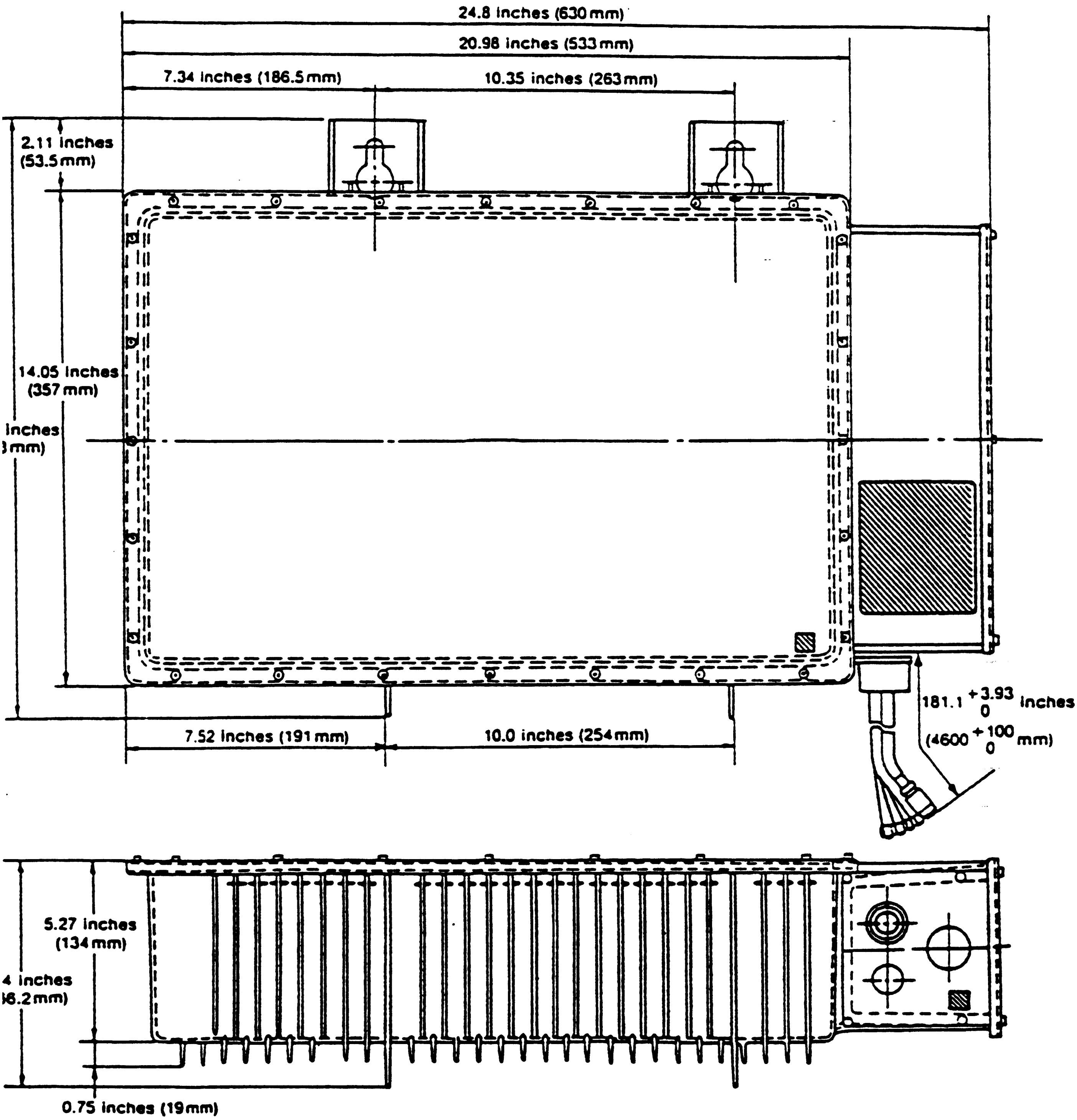


Figure 2.2.2-1. IF Electronics Assembly Mounting Dimensions

2.3 Interconnections

See Figure 2.3-1. Connectors for the IF Unit are inside an enclosure at the right end of the unit (as it is normally mounted). Remove the cover (A panel) for access to these connectors.

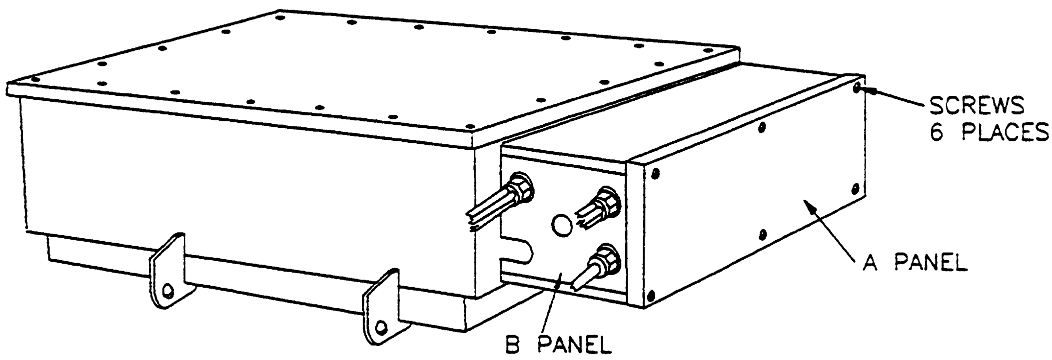


Figure 2.3-1. Access to IF Unit Connectors

Four Coaxial cables with SMA connectors are used to interconnect the RF and IF units. A multiconductor cable connects power to the RF unit, and provides monitor and control interface. These cables pass through a cable bulkhead plate (B panel) which is installed in a slot at the bottom of the connector enclosure. Cables are numbered to correspond with the connectors.

If the unit is not shipped with the cables and bulkhead plate installed, install the bulkhead plate.

CAUTION

DO NOT OVER-TIGHTEN SMA CONNECTORS. CORRECT TORQUE IS 8 INCH-POUNDS, JUST BEYOND FINGER TIGHT.

See Figure 2.3-2. Match the numbers on the cables and connectors, and interconnect the four units.

CAUTION

SUPPLEMENTARY WEATHERPROOFING OF ALL EXPOSED CONNECTORS IS RECOMMENDED.

Cable signals are shown in Table 2.3-1.

Table 2.3-1. Signals on Interconnecting Cables

Cable	Signal
1	1.3 GHz input to RF unit (Transmit)
2	Receive output from LNB, 950 to 1450 MHz
3	4 GHz transmit reference to RF unit
4	Receive reference to RF unit (2.6875 GHz for ASU units; 2.825 GHz for ASE units; 2.500 GHz for AST units)
5	DC Power and fault, as follows: Pin 1: +11 Vdc out to RF unit Pin 2: -8 Vdc out to RF unit Pin 3: Shield ground Pin 4: RF summary fault

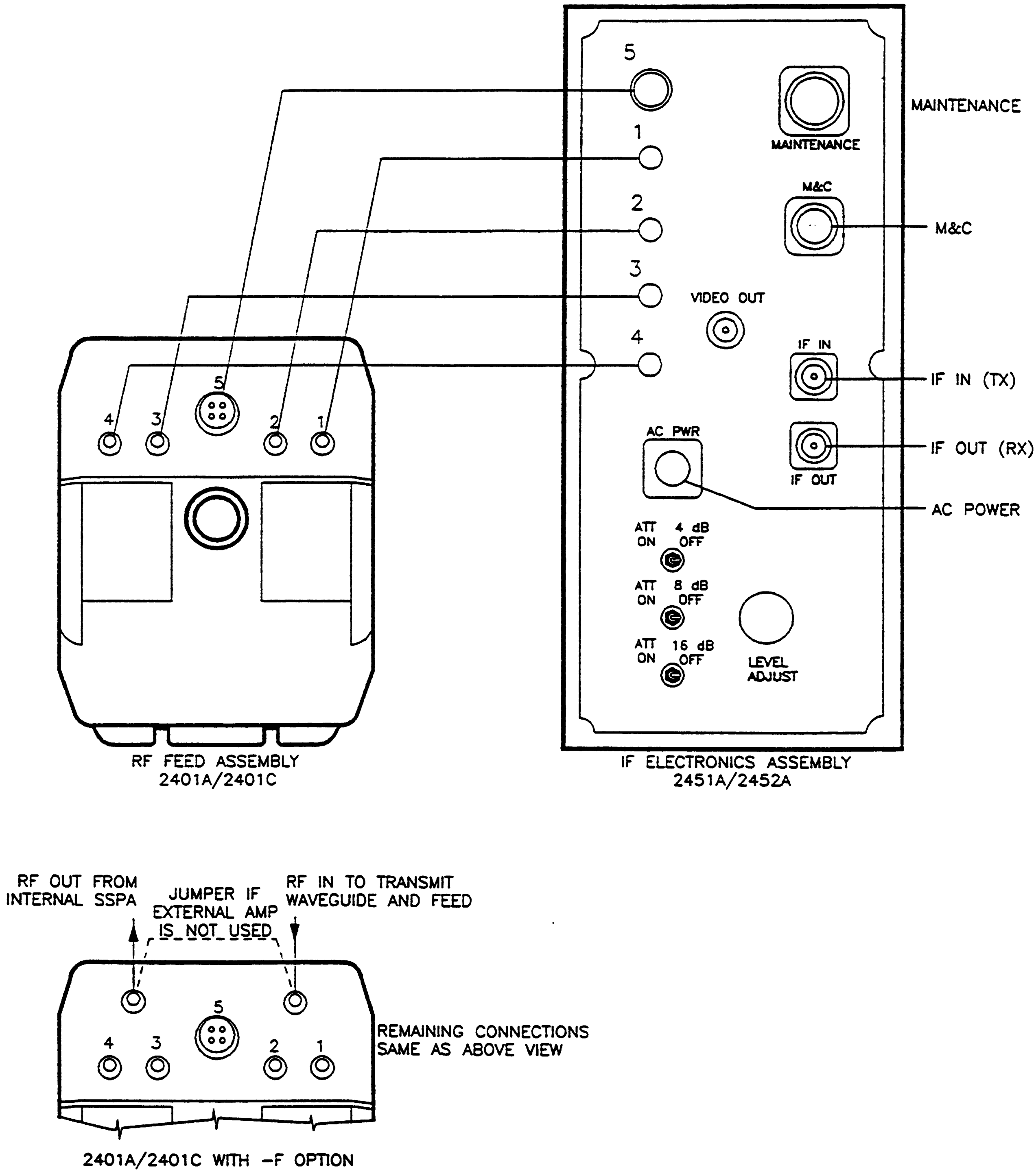


Figure 2.3-2. Interconnection Between Units

WARNING

THE IF AND RF UNITS CONTAIN DANGEROUS VOLTAGES AND SIGNALS, AND ARE HERMETICALLY SEALED TO PREVENT MOISTURE DAMAGE. NEVER OPEN A UNIT UNDER FIELD CONDITIONS. OPENING A UNIT VOIDS WARRANTY, AND MAY EXPOSE THE WORKER TO DANGEROUS VOLTAGES OR MICROWAVE SIGNALS. SERVICE OF THESE UNITS MUST BE PERFORMED ONLY BY TRAINED TECHNICIANS USING SPECIAL EQUIPMENT.

2.4 Interface Connections

CAUTION

MAKE SURE POWER AND IF CABLES ARE ROUTED THROUGH STUFFING BUSHINGS IN THE BULKHEAD PLATE, TO MAINTAIN WEATHERSEAL.

The following connections are provided on the IF unit:

1. AC power: 117 Vac ±10%, 47-63 Hz, 1.5 A, or (Models with ASE suffix) 230 Vac ±10%, 47-63 Hz, 0.75 A. Power cable is supplied with the IF unit, with 4 pin connector installed for IF unit end. Connector for opposite end is typically customer-supplied. Connector pinout is shown in Table 2.4-1.

2. IF OUT: Type N male connector, (50 ohms) required. Receive signals from the IF unit, in the vicinity of 70 MHz (Model 2452A) or 140 MHz (Model 2451A).

3. IF IN: Type N male connector, (50 ohms) required. Transmit signals to the IF unit, in the vicinity of 70 MHz (Model 2452A) or 140 MHz (Model 2451A). If optional operation of Model 2451A with external 10 MHz standard is used, the 10 MHz reference signals are diplexed on this input with the transmit IF signals.

4. VIDEO OUT: BNC Male connector required. Broadband IF signals in the range 950 to 1450 MHz, for connection to a satellite video receiver that tunes this band. (75 ohms)

5. M & C: Monitor and Control signals from indoor equipment, 9 pin connector. Pinout is shown in Table 2.4-2. Levels are RS-485.

6. MAINTENANCE: This provides connection to a portable computer for test and frequency programming, if required. Levels are RS-232C.

Refer to the Terminal Installation Handbook for Interfacility Link cable and connector recommendations.

Table 2.4-1. Pinout, AC Power Connector

Pin	Function
1	AC (Common)
2	No connection
3	AC (hot)
4	Ground

Table 2.4-2. Pinout, Monitor and Control (M & C) Connector

Pin	Function
1	Ground
2	Maintenance (to pin 11 of Maintenance Connector)
3	Serial Data TXD+ (TXD-B)
4	Maintenance (to pin 12 of Maintenance Connector)
5	Serial Data RXD+ (RXD-B)
6	Maintenance (to pin 13 of Maintenance Connector)
7	Serial Data TXD- (TXD-A)
8	Maintenance (to pin 14 of Maintenance Connector)
9	Serial Data RXD- (RXD-A)

Signals looped to Maintenance connector are designed for special applications such as an installation voice intercom between indoor and outdoor equipment.

2.5 Operation of Controlling Computers

Monitor and Control of the complete outdoor electronics may be provided by an IBM[R] Personal Computer or Compatible with Skydata-developed custom software, or by the hand-held Maintenance Controller. The Maintenance Controller is a small battery-powered computer used for frequency programming and terminal operation. The hand-held computer connects to the Maintenance connector on the IF unit, via a special RS-232C cable.

Separate manuals are provided by Skydata for both version of the controlling software.

Pinout of the Maintenance Connection is shown in Table 2.5-1.

Table 2.5-1. Pinout, Maintenance Connector

Pin	Function
1	No connection
2	SVC - TXD
3	SVC - RXD
4	No connection
5	No connection
6	No connection
7	Signal ground
8	SVC - RTS
9	No connection
10	No connection
11	Maintenance (to M & C connector pin 2)
12	Maintenance (to M & C connector pin 4)
13	Maintenance (to M & C connector pin 6)
14	Maintenance (to M & C connector pin 8)

Section 3

OPERATION

3.0 OPERATION

3.1 General

The RF and IF Units are designed for remote monitor and control via a serial data interface and an external controller, either through the M&C port or the Maintenance port. This monitor and control is used to select transmit and receive frequencies, to turn output drive on and off, and to provide detailed information if a fault occurs in outdoor equipment.

The Skydata Model 5017 Controller is designed to provide remote control and fault monitoring of the RF/IF unit; it may also be controlled by an IBM[R] PC or compatible computer with custom software (available from Skydata), via signals interfacing through the Maintenance or M&C port. Contact Skydata for more information.

Once the units have been installed, tested and programmed up for normal operation, a controller is not necessary for normal operation. Frequency programming, once entered into the IF Unit, is stored in non-volatile (battery-backed) RAM. If AC power fails to the equipment, the units will return to normal operation on the programmed frequency when power is restored.

3.2 Transmit Power Control

Attenuator switches and an adjustable attenuator are provided on the RF/IF Unit to control the input power (and thus the output power) of the transmit signal. Attenuator switch increments are 4, 8 and 16 dB (additive); the variable attenuator has a range of 0 to 10 dB (linear mode). **Skydata recommends that persons using this equipment establish a careful procedure for monitoring and setting the transmit signal level of this equipment to the satellite, so proper network EIRP levels are maintained.**

Section 4

THEORY OF OPERATION

4.0 THEORY OF OPERATION

4.1 System Configuration

A typical VSAT installation is shown in block diagram form in Figure 4.1-1. The antenna system collects Ku-band receive signals (a selected band in the range 10.95 to 12.75 GHz, depending on Model) from the satellite and focuses the signals to the "feed." Receive signals are routed through a Transmit Reject Filter (TRF), to prevent overload of receive equipment by transmit signals. The receive signals are amplified and converted down to L-band (950 to 1450 MHz) within the RF Unit, and routed to the IF Electronics Unit for final downconversion to a frequency band centered on 70 MHz (140 MHz optional). The downconverted signals are transmitted over coaxial cable in the "interfacility link" (IFL) to indoor equipment. A separate IFL coax (not shown) carries video signals (at 950 to 1450 MHz) to video receive equipment, if required.

Transmit signals from the customer's equipment in the vicinity of 70 MHz (140 MHz optional) are transmitted over the IFL to the IF Electronics Unit outdoors. In this unit and the RF unit the signal is upconverted to Ku-band (14,000 to 14,500 MHz). This signal is amplified to a power level (typically) of about one watt. This signal is connected to the feed, and illuminates the reflector (dish) to generate a narrow RF beam directed toward the satellite.

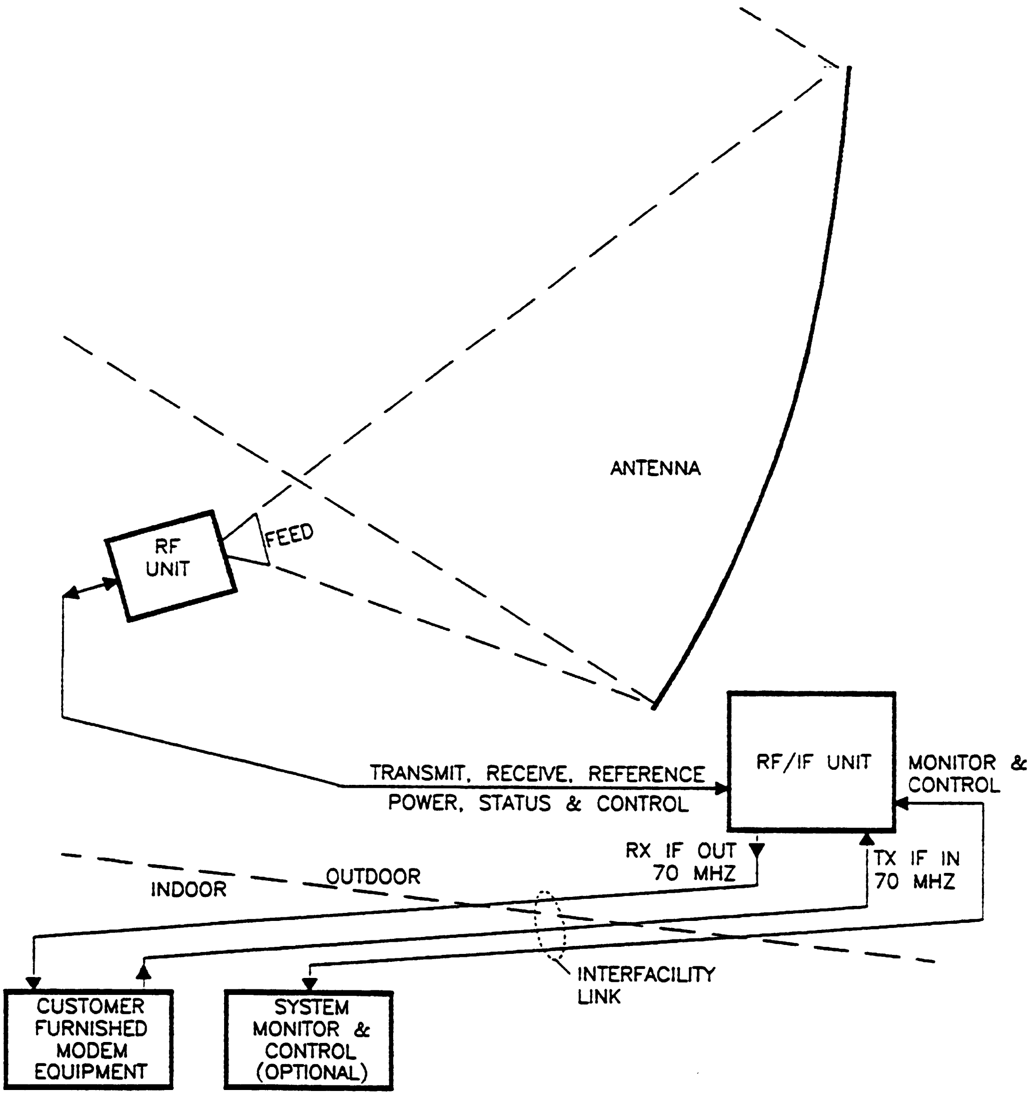


Figure 4.1-1. Block Diagram, Ku-Band VSAT System

Equipment Racks

Intro

With a standard install Orion supplies an equipment rack. Orion has many years of experience with different types of equipment racks. Orion uses only equipment racks who meets Orions high specifications. Only by high exeption Orion allows the cumstomer to use their own equipment rack. Orion supplies to their customer's three different types of equipment racks. One of the equipment racks is integrated by Nortal Dasa and is used for VISN-Boxes (VERO Rack). The other two racks are normally used for SCPC links.

In a standard Orion equipment rack the following equipment is fit in.

A PSTN modem.
A LCP III or LCD.
A Fairchild SM 2800 Modem.
A Blower.
An UPS.

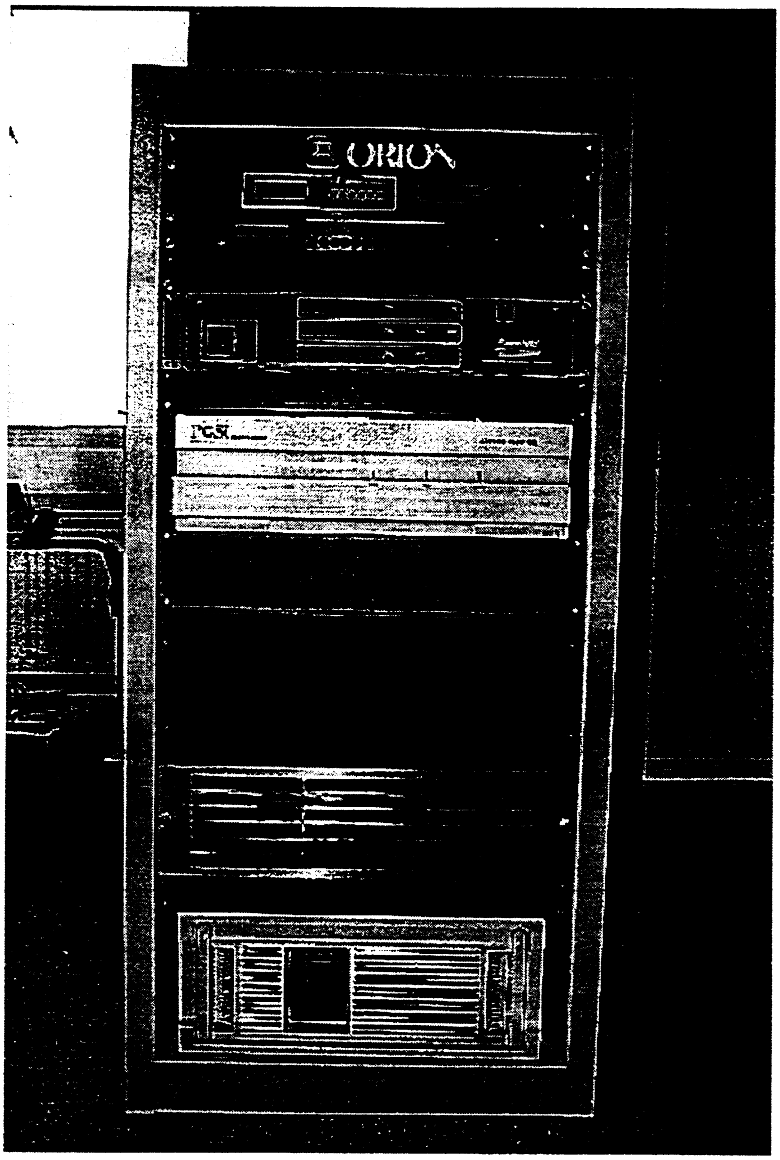
The three types of equipment racks are;

1. BUD Rack.
The Bud Rack is integrated in the US. It is shipped to customers in the US as well in Europe. It is normally build for SCPC links.

2. SCHROFF Rack.
The SCHROFF Rack is integrated in the Netherlands by Getronics and is shipped to customers in Europe. It is normally build for SCPC links.

3. VERO Rack.
The VERO Rack is integrated in Germany by Nortel-Dasa. It is normally build for VISN Equipment.

BUD Rack front side (US Build)



←PSTN Modem
←LCP III

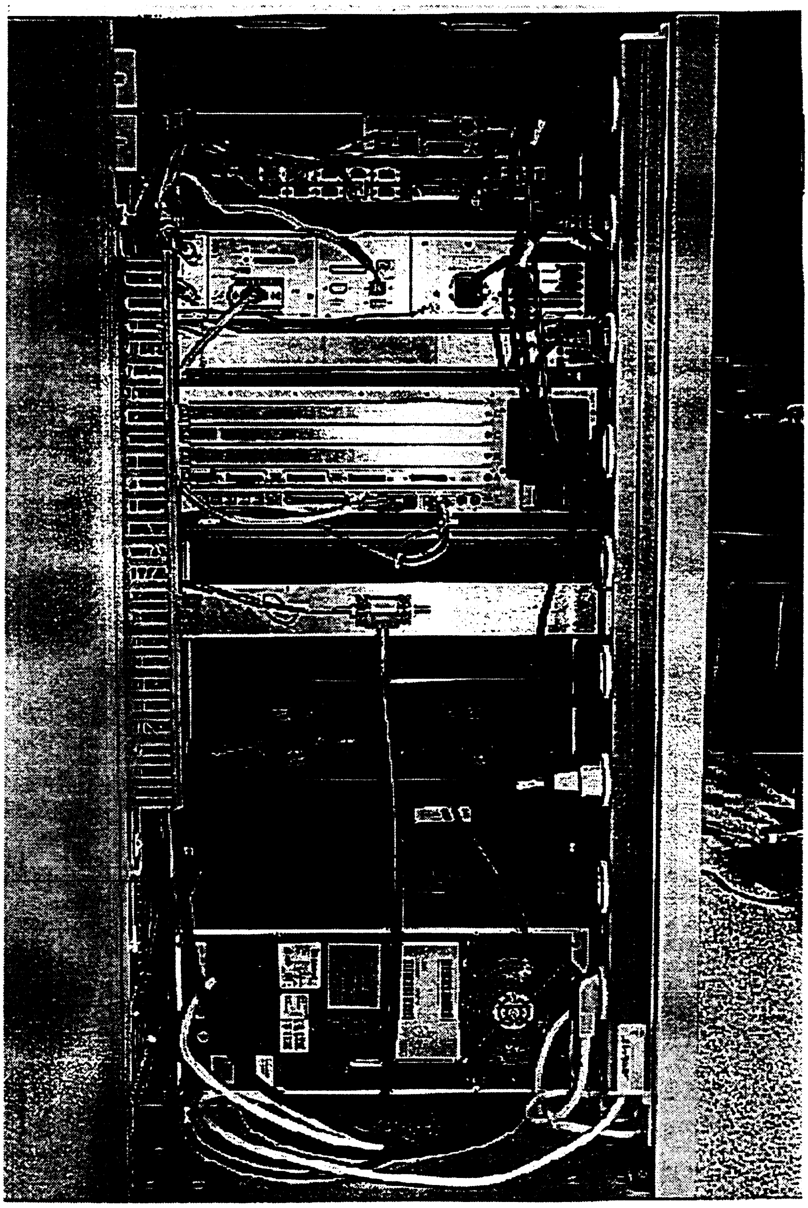
←Fairchild SM 2800 Modem

←PCSI Access Plus 100 Multiplexer.

←Blower

←Liebert UPS

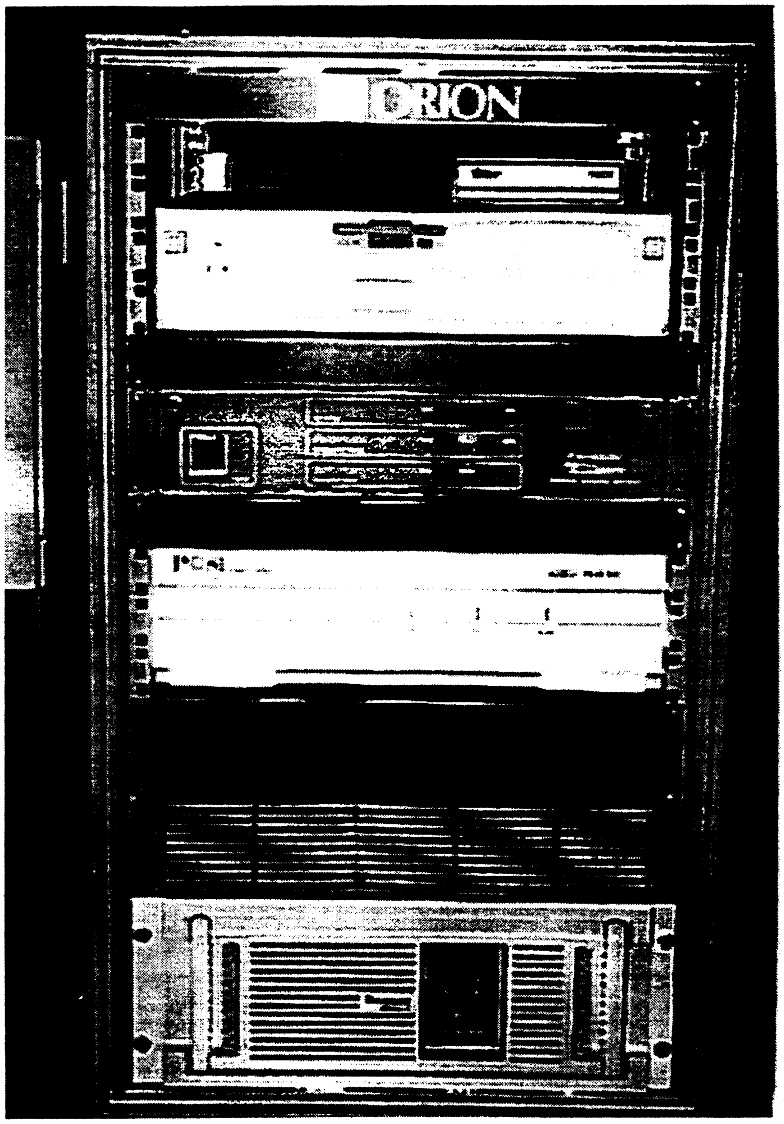
BUD Rack back side (US Build)



←PSTN Modem
←LCP III
←Fairchild SM2800 Modem
←PCSI Access 100 Plus
←Blower
←Liebert UPS

BUD Rack front side close up (US Build)

Schroff Rack front side (EU Build)



←PSTN Modem
(Victory 2400)

←LCD

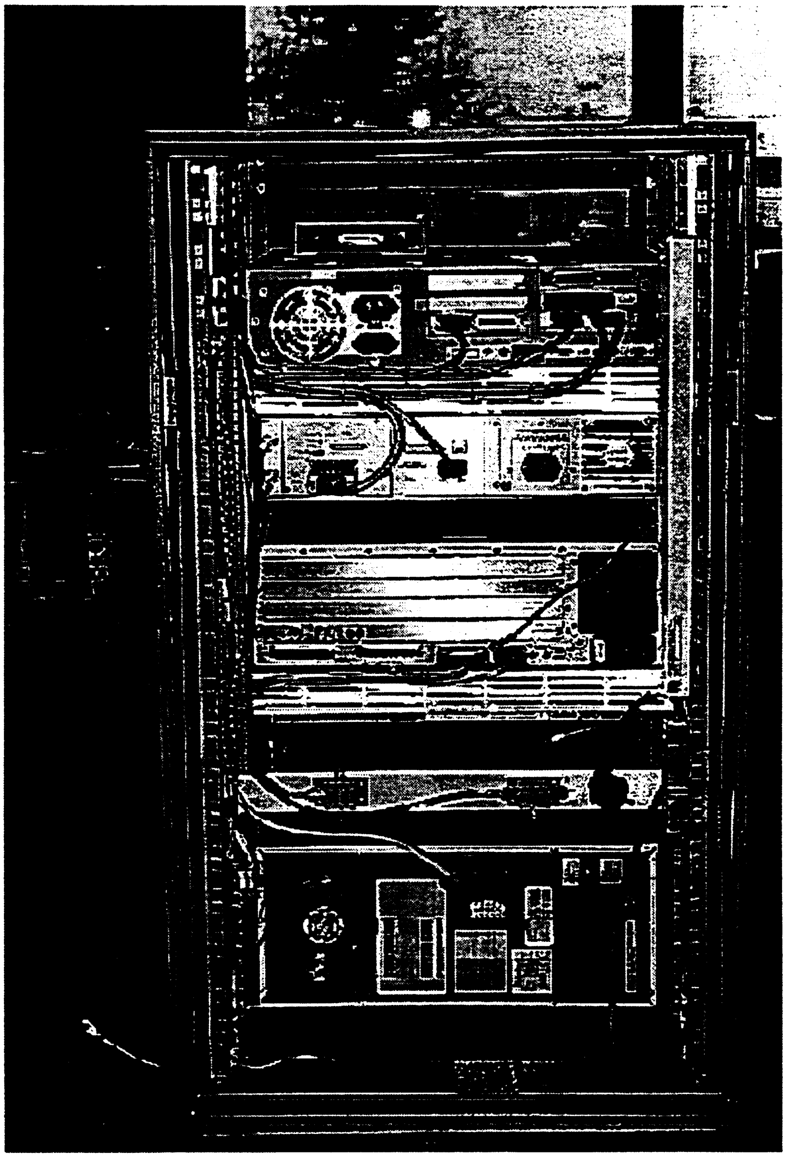
←Fairchild SM 2800
Modem

←PCSI Acces Plus
100 Plus

←Blower

←Liebert UPS

Schroff Rack back side (EU Build)



←PSTN modem

←LCD

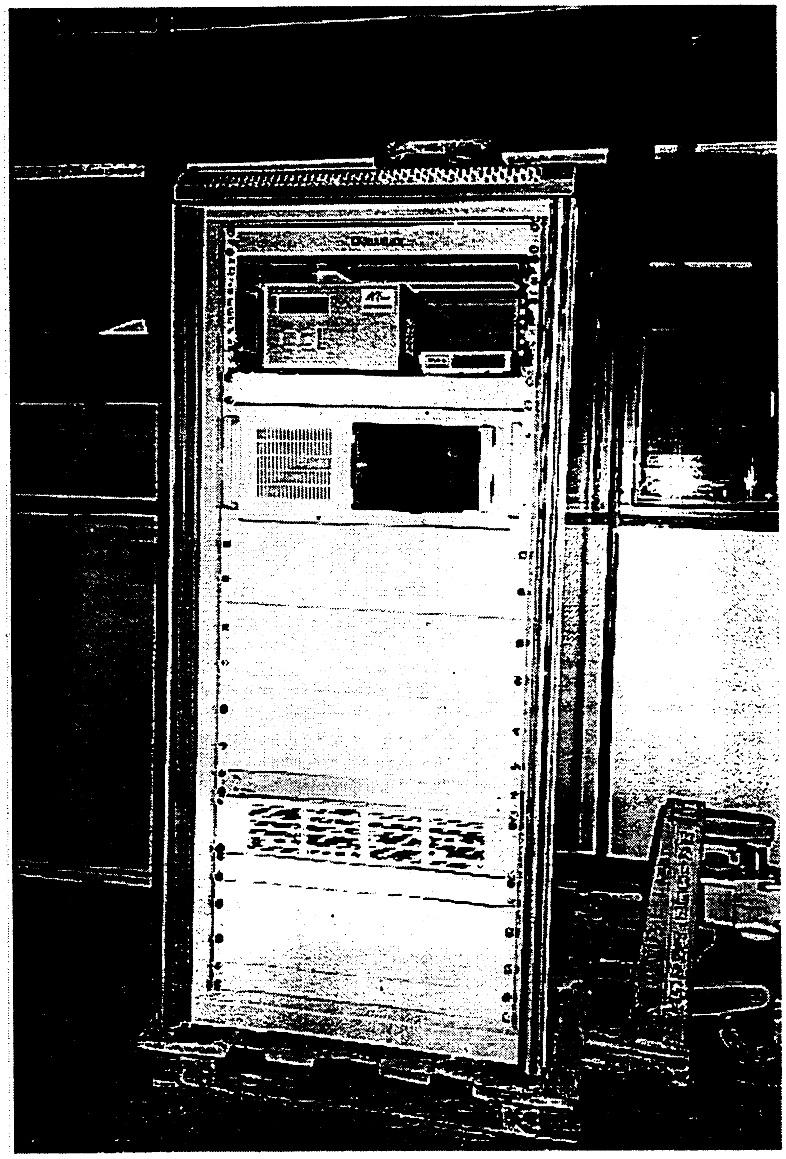
←Fairchild SM2800 Modem

←PCSI Access Plus 100 Multiplexer

←2 Two Way Splitters

←Liebert UPS

VERO Rack (EU Build)



←ACT SDM-JFP Multiplexer + PSTN Modem

←VISN Box

←Blower

SECTION 1 - GENERAL DESCRIPTION

1.1 Introduction

The SM2800 is a low-cost satellite modem designed after Fairchild's field-proven SM290/2900 Series of industry standard satellite modems. Like the SM290/2900, the SM2800 interfaces with 70 or 140 MHz IF Satellite Communications equipment to facilitate the transmission and reception of satellite-relayed digital data. The SM2800 Satellite Modem is designed to operate in low cost SCPC configuration data links. It accommodates data rates ranging from 9.6 Kbps to 512 Kbps using 1/2 or 3/4-rate encoding and BPSK or QPSK modulation. V.35 and RS422 data interfaces are available and are field-changeable.

SM2800 Features

- *Operates in SCPC Configured Data Links*
- *Full-Duplex or Simplex (Rx Only) Configurations*
- *9.6 to 512 Kbps Data Rates Using 1/2 or 3/4 Encoding and BPSK or QPSK Modulation*
- *Exceptional Bit Error Rate (BER) Performance*

Error correcting convolutional encoding and soft-decision sequential or Viterbi decoding provide exceptional Bit Error Rate (BER) performance. Actual modem performance using sequential decoding is guaranteed not to deviate from theoretical performance by more than 1.1 dB for all combinations of data scrambling, temperature, data rate and code rate.

The SM2800 is available in full-duplex or simplex (receive only) configurations. Fault monitoring, V.35 scrambling, digital loopback, and Monitor and Control Interface are standard on all units.

1.2 Functional Description

The SM2800 Modem has two primary types of interfaces: data and RF. The data interface is a two-way data communication path that interconnects with customer-furnished data processing equipment. The RF interface provides two-way communication with the satellite via the uplink and downlink.

Transmit data is applied to the SM2800 modulator board via the changeable data interface and the M&C board. In the modulator, the data is scrambled, encoded for forward error correction, and then imposed on a 70 or 140 MHz carrier using BPSK or QPSK modulation. The modulated carrier is amplified, bandpass filtered, and applied to the RF output connector. The received RF enters the SM2800 through the RF input connector on the demodulator board. The demodulator separates the data from the carrier, decodes and descrambles the data, and applies the interface.

1.3 Physical Description

The standard SM2800 houses a modulator board, a demodulator board, an M&C board and a Universal input Power Supply. LED indicators mounted on the modulator, demodulator and M&C boards show status and are visible through the front panel.

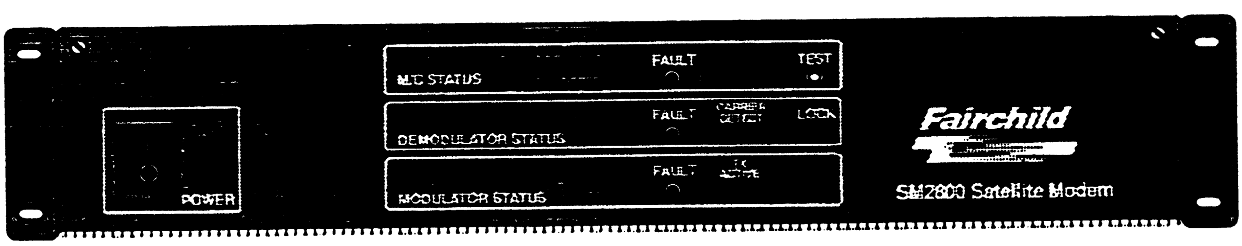


Figure 1-1. SM2800 Satellite Modem

The front panel is hinged to allow simple replacement of the major subassemblies and access to the RJ11 connector, used for interfacing the optional Handheld Terminal. The rear panel features the changeable data rate interface, a BNC input connector for user-supplied station clock, modulator output and demodulator input BNC connectors, a fault connector, M&C Host Interface connectors and an expansion connector. The SM2800 Chassis is 3-1/2 inches high by 17-inches deep and mounts in a standard 19-inch rack.

1.3.1 Modulator

The modulator uses the data and clock output of the M&C board to produce a BPSK or QPSK modulated IF carrier after encoding. The carrier frequency is variable from 52 to 88 MHz or from 104 to 176 MHz in 2.5 KHz steps. A filter eliminates out-of-band RF components. The modulator board includes:

- 52 to 88 MHz or 104 to 176 MHz frequency synthesizers to provide the transmitter selectable tuning in 2.5 KHz steps
- The FEC encoder accepts data and clock lines from the M&C board and provides a convolutionally encoded output to the Modulator
- V.35 (CCITT), Linkabit compatible, or V.35 (IESS 308) scrambler
- BPSK/QPSK modulator
- Power level circuitry
- Differential Encoder

1.3.2 Demodulator

The demodulator accepts 52 to 88 MHz or 104 to 176 MHz IF input and performs BPSK/QPSK demodulation at a frequency determined by the frequency synthesizer. The demodulator output is applied to the decoder input where data is recovered. The demodulator board includes:

- 96 to 134 MHz or 188 to 220 MHz frequency synthesizer
- 2-stage IF
- Costas loop demodulator
- Symbol clock recovery
- 1/2 or 3/4 rate soft-decision sequential or Viterbi decoder that accepts soft-decision outputs from the Demodulator, and provides data and clock outputs to the M&C board. The Decoder performs sequential or Viterbi decoding and V.35 (CCITT), V.35 (IESS 308), or Linkabit compatible descrambling before applying the output to the M&C board.

1.3.3 Monitor and Control (M&C)

The M&C board provides a full set of clock options which are user-selectable. Choices exist for control of the modulator clock source to be from the data interface, the modem internal stable clock, station clock or receive clock. Choices for the receive buffer clock may be the transmit clock, the modem internal stable clock, station clock or the receive demodulator clock.

The board contains a microprocessor which provides all monitor and control functions for the modem. A remote Host Interface as well as a handheld terminal interface is provided for complete control of the modem selections and parameters. Two control programs are also provided on floppy disk for use with IBM and compatible personal computers. The M&C board includes:

- Transmit data buffer
- Receive data buffer
- Clock switching and recovery
- Clock monitors
- Microprocessor, RAM and ROM program storage
- Host and Handheld Terminal Interfaces

SECTION 2 - INSTALLATION AND HARDWARE CONFIGURATION

2.1 Unpacking

NOTE
All cartons and packaging materials should be retained for possible future use.

Inspect shipping containers for damage. If shipping containers are damaged, they should be kept until the contents of the shipment have been carefully inspected and checked for normal operation.

Remove the packing list from the outside of the shipping carton. Open the carton and remove contents, checking each item against the packing list. Verify completeness of the shipment and normal operation. If any item is missing or damaged, notify this manufacturer. If the shipping carton is damaged, notify the carrier as well as this manufacturer. Keep all shipping materials for the carrier's inspection.

2.2 Mounting

If the unit is to be rack mounted, be sure to allow sufficient clearance for proper ventilation, cable connections and access to controls. The following may be used as a guide:

Chassis Surface–	Minimum Clearance	
Right and Left Sides–	1.5 inches	
Rear Panel–	6 inches	Maintain clear passage for air flow from unit exhaust fan located on the right (when viewed from the rear).
Front Panel–	30 inches	

2.3 Installing Modules

CAUTION
Handle all modules by edges, never by components. If necessary to lay a module down, position with the component side up. Protect both sides of circuit cards. Modules contain static sensitive components. DO NOT TOUCH EDGE CONNECTOR TERMINALS.

Figure 2-1 shows the location of modules within the chassis. All modules are installed component side up and in the designated location within the chassis.

Each module box is marked with the module name and serial number, and the chassis is marked with its serial number. Verify that each module is being installed in the chassis with the specified serial number. Prior to installing each module, refer to Section 3 for hardware configuration which may be required.

As each module is installed in its slot, press firmly to assure adequate seating of the module. As the data interface is installed, assure alignment with the two connectors on the motherboard and press firmly into place using the handle provided, then tighten the holding screws on the interface.

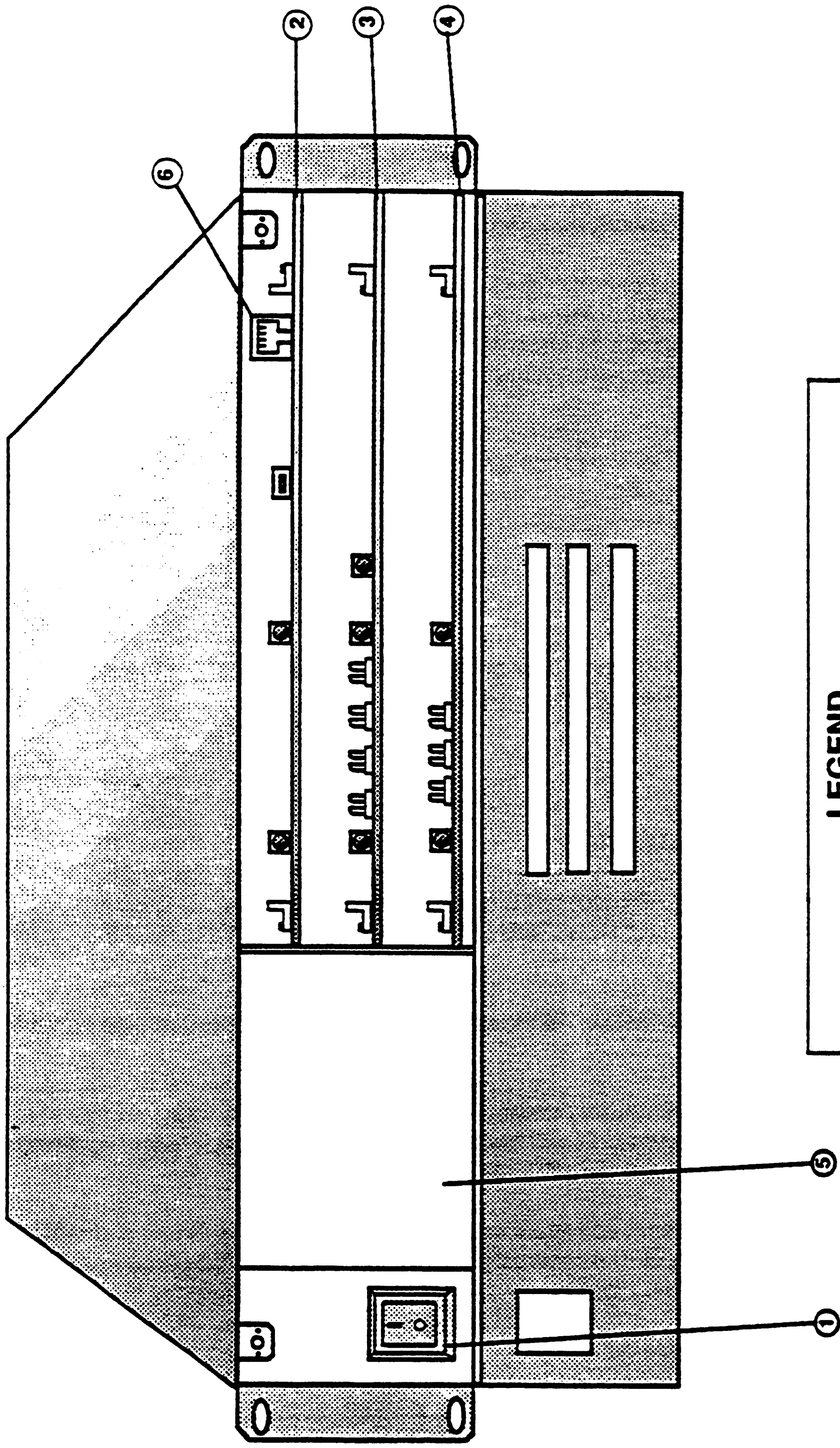
2.4 Hardware Configuration/Chassis and Power Supply

The power supply requires no adjustments prior to module insertion or with any module exchange.

WARNING
The SM2800 power supply should be serviced only by a qualified technician. Removal of the chassis cover to access the power supply can allow exposure to high voltage. The AC line cord must be disconnected from the unit when the cover is removed to prevent exposure to high voltage.

2.4.1 Modulator Board

The modulator board contains no configuration jumpers which are field changeable. Do not alter the setting of factory jumpers which are in place on the module.



LEGEND

1. Power ON/OFF
2. M&C Module
3. Demodulator Module
4. Modulator Module
5. Power Compartment
6. Handheld Terminal Interface Connector

Figure 2-1. SM2800 Module Locations

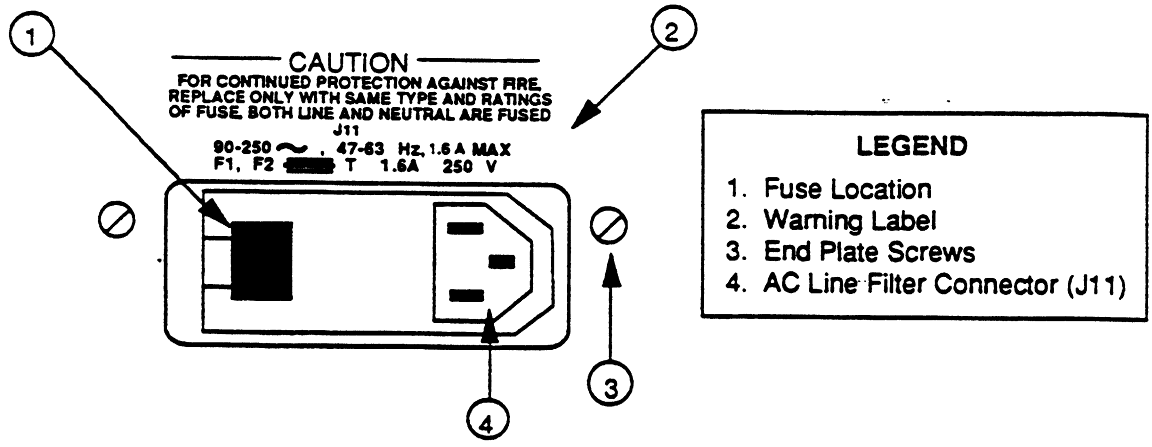


Figure 2-2. Rear Panel Fuse Location

2.4.2 Demodulator Board

The demodulator board contains no configuration jumpers which are field changeable. Do not alter the setting of factory jumpers which are in place on the module.

2.4.3 M&C Board

The M&C board contains four configuration jumpers (refer to Figure 5-2). If this modem is to be installed on the RS485 bus, it must first be determined whether or not this unit is at the end of the chain. If so, the RS485 bus must remain terminated. The required termination is provided on the M&C board. To remove the internal terminators, remove the shunts across the two pins of TP7 and also across the two pins of TP8.

The M&C board contains a third set of jumpers to allow the termination of the BNC Station Clock input. The factory preset condition is terminated. To remove the internal 75-ohm termination, remove the shunt across the two pins of TP4.

The M&C board contains a fourth configuration jumper which allows for the selection of Host Interface control to be from the RS485 input on J9 or the RS232 input on J9. The factory preset condition is RS232. If the multidrop RS485 Host Interface will be used, then remove the shunt or jumper from TP2 and place on the two pins of TP3.

2.5 Cabling and Connectors

After configuring the modules and installing in the chasssis, proceed to install the external cabling.

Cabling is not provided with the modem due to the wide variety of possibilities. Tables 2-1 through 2-7 present the pin function for each of the connectors on the rear panel of the SM2800 including the field changeable data interface. A brief description of the connector functions follow.

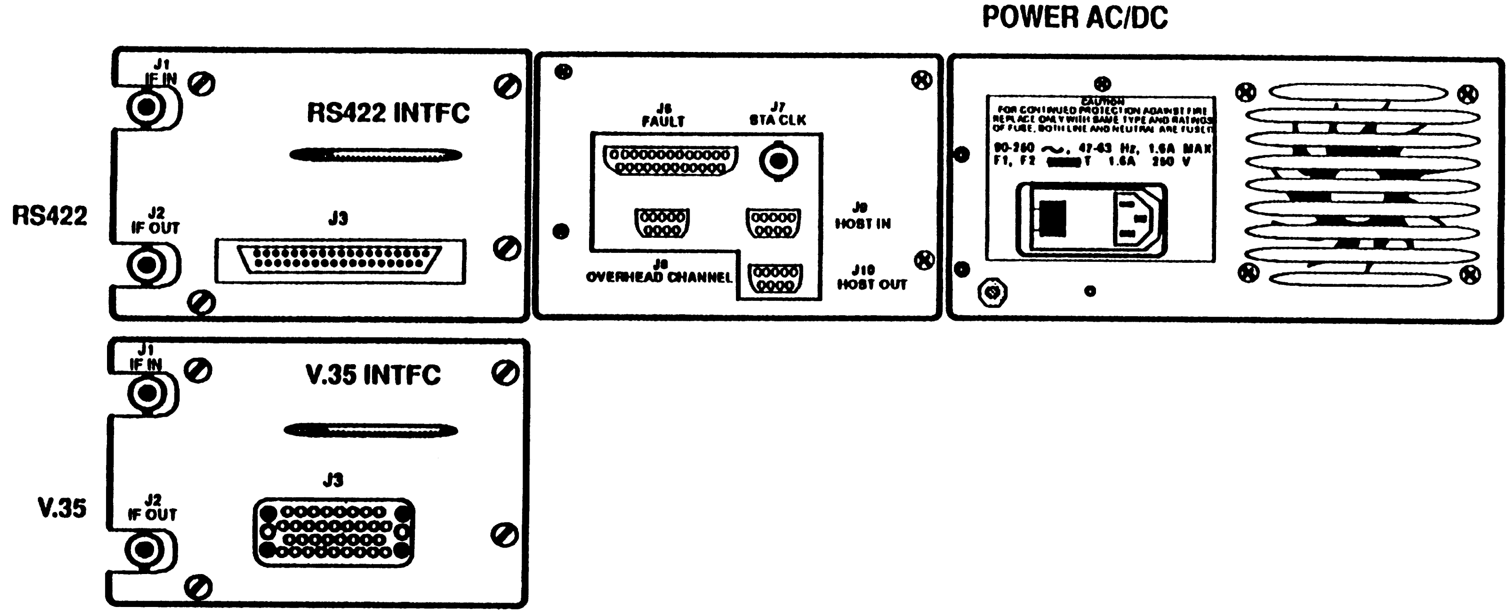
J1 is the IF Input BNC connector. The mating connector should be a 75-ohm male BNC, although a 50-ohm BNC will work with slightly degraded VSWR.

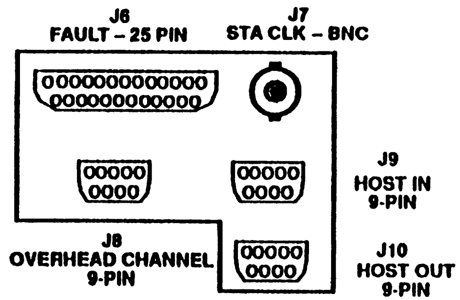
J2 is the IF Output BNC connector. The mating connector should be a 75-ohm male BNC.

J3 is part of the field changeable data interface. See the appropriate tables which follow. The data interfaces support RTS/RS (Request to Send) which enables the modulator, and RR (Receiver Ready) on both the V.35 and the RS422 interface.

J6 is the fault connector. In addition to providing access to the form C relay fault closures. this connector contains two open collector TTL fault signals, input for an RS422 Station Clock, and one of 3 RS485 Host Interfaces.

SM2800 Rear Panel





Recommended Connector Backshields

9-Pin backshield (One-piece metal) TRW Cinch DE-24657 or equivalent

25- Pin backshield (One-piece metal) TRW Cinch DB-24659 or equivalent

Figure 2-3. SM2800 Rear Panel and Optional Interfaces

J7 is the Station Clock BNC connector. The mating connector should be a 75-ohm male BNC.

J8 is a 9-pin expansion connector for future options.

J9 is the Host IN connector. The mating connector should be a DB9 male style. This connector contains the second of 3 RS485 Host Interfaces. J9 also includes a point-to-point RS232 interface.

J10 is the Host OUT connector. The mating connector should be a DB9 male style. This connector contains the third RS485 Host Interface.

J9 and J10 are parallel connected. Two connectors are provided for the racking situation when the host interface ports are daisy chained. The two connectors allow for one cable to be constructed to daisy chain any number of modems together, simply by cabling Host OUT to Host IN.

Table 2-1. J1, J2 - Modem IF Connectors (BNC / Female)

Connector	Function
J1	IF IN (75 Ω)
J12	IF OUT (75 Ω)

Table 2-2. J7 - Station Clock Input Connector (BNC / Female)

Connector	Function	Signal Direction
J7	STATION CLOCK	IN

Table 2-3. J3 - V.35 Interface
34-Pin Winchester Connector (Female)

Pin	Signal Direction	Signal	Description
A		GND	Signal Ground
B		GND	Signal Ground
C	Input	RTS-A	Optional Request To Send (Carrier ON/OFF-A (RS-422 Carrier ON/OFF)
D			Not Used
E			Not Used
F	Output	Carrier Detect-A	Carrier Detect-A (RS-422 Carrier Detect or Decoder Lock)
G			Not Used
H			Not Used
J	Output	Carrier Detect-B	Carrier Detect-B (RS-422 Carrier Detect or Decoder lock)
K	Input	RTS-B	Optional Request To Send-B (RS-422 Carrier ON/OFF)
L			Not Used
M			Not Used
N			Not Used
P	Input	SD - (A)	Send Data-A
Q			Not Used
R	Output	RD - (A)	Receive Data-A
S	Input	SD + (B)	Send Data-B
T	Output	RD + (B)	Receive Data-B
U	Input	SCTE - (A)	Serial Clock Transmit EXT-A
V	Output	RT - (A)	Receive Timing-A
W	Input	SCTE + (B)	Serial Clock Transmit EXT-B
X	Output	RT + (B)	Receive Timing-B
Y	Output	SCT - (A)	Serial Clock Transmit-A
Z			Not Used
aa	Output	SCT + (B)	Serial Clock Transmit-B
bb			Not Used
cc			Not Used
dd			Not Used
ee			Not Used
ff			Not Used
gg			Not Used
hh			Not Used
mm	Output*	Tx FLT TTL	Transmit Fault - TTL level Signal
nn	Output*	Rx FLT TTL	Receive Fault - TTL Level Signal

*Open Collector (Lo = Ok, Hi = Fault)

SECTION 3 - CONFIGURATION

3.1 Introduction

The following paragraphs provide the procedures and information necessary to properly configure the SM2800 Satellite Modem.

The SM2800 is optionally preconfigured with the customer information provided at the time of order when it is shipped from the factory. If the SM2800 is shipped without being preconfigured, it is then necessary to reprogram the unit on site.

Reprogramming the unit can be accomplished in a variety of ways. The optional handheld terminal may be used, or software provided with the unit may be used. The software provided consists of two versions executable on the IBM PC or compatibles.

The first program is titled "HANDHELD," and is an exact emulation of the handheld terminal. This program requires the following minimum equipment:

- IBM PC, XT or AT; or compatible;
- DOS 3.1 or later;
- one COMM port;
- Monochrome, CGA, EGA or VGA monitor and compatible video card;
- 640 Kb memory; and
- one high-density 5-1/4" (1.2 Mb) floppy disk drive.

The second program is titled "SM2800." This program provides more flexibility than "HANDHELD" as well as monitor capability, configuration storage, retrieval and programming. Control of racked modems is also possible with this program. The program operates in the Microsoft Windows™ environment. The program requires the following minimum equipment:

- IBM PC AT (386 or better) or equivalent;
- 2 Mb extended memory plus 640 Kb main;
- EGA or VGA monitor with compatible video card;
- one high-density 5-1/4" (1.2 Mb) floppy disk drive;
- one COMM port (2 recommended);
- optional mouse (recommended);
- DOS 3.1 or later (DOS 5.0 recommended); and
- Microsoft Windows™ version 3.0 or later.

3.2 General Clock Options

The SM2800 provides a full set of clock options typically available only on higher priced units. The use of these options can be complicated, but provide for full flexibility in the application of the modem. A complete understanding of the implementation of these options is necessary to be able to choose the proper option for the application. Figure 3-1 presents the block diagram of the clock options.

Referring to Figure 3-1, STACLK is the station clock input to the M&C board from the RS422 input and STCLKBNC is the station clock from the BNC input. These two inputs are multiplexed by the station clock mux to select the connector source. The selection begins with the user programmed choice. The choice is monitored for activity, and if the selected input fails, the modem automatically searches the other input. If activity is found, the modem resumes operation with the other input selected. Should the selected input become valid, the modem then resumes operation on the selected input. In the figure, the selected source is then used as the station clock source for additional clock option multiplexing. In the event that continued failure is sensed from the station clock inputs, the modem will revert to using the internal station clock until one or the other station clock inputs becomes valid.

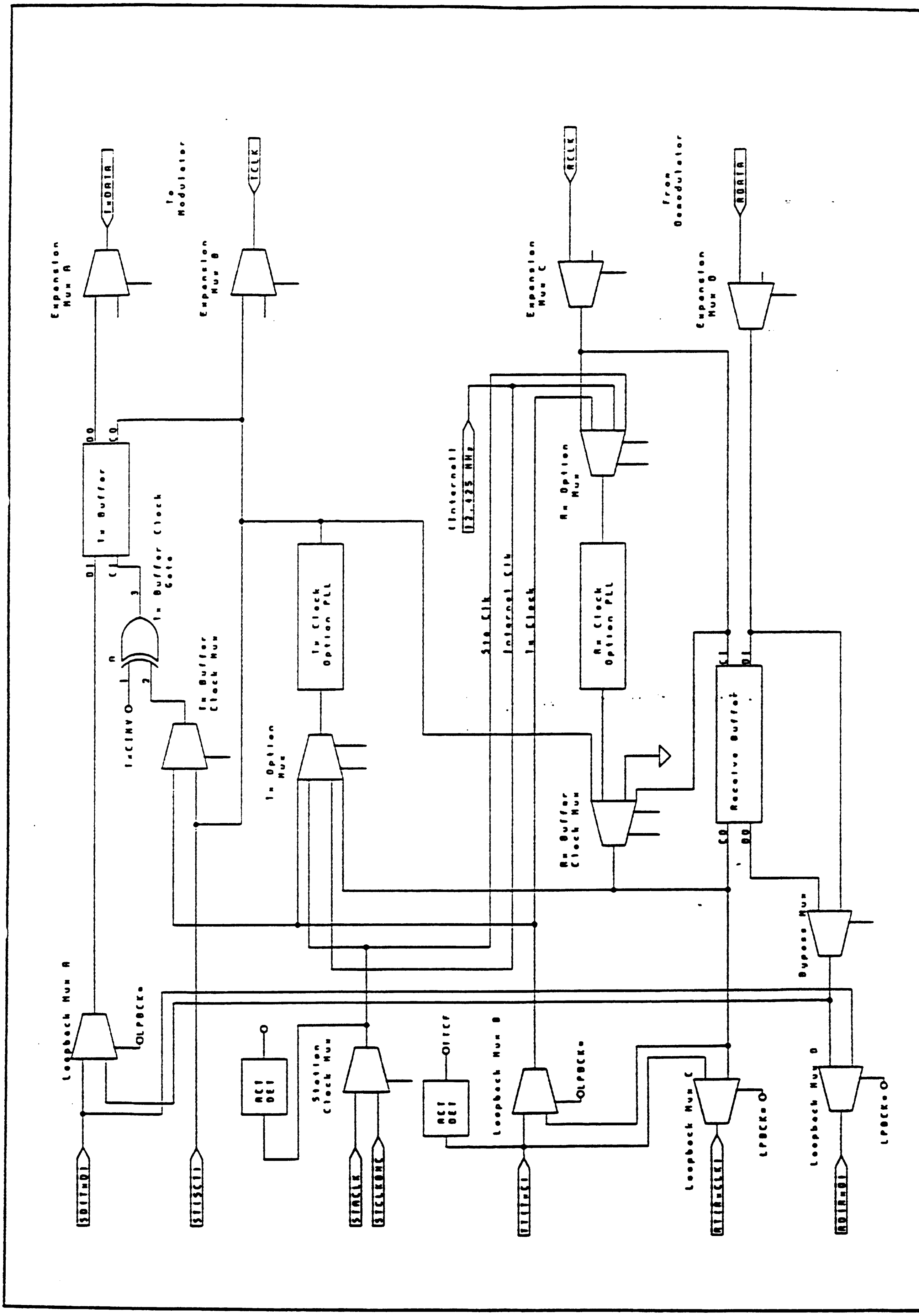


Figure 3-1. Clock Options Diagram

Send data (SD) or transmit data, (TxD) is routed to one section of the loopback multiplexer (A). If not commanded to loopback, the transmit data is provided to the Tx buffer data input (DI). The function of the Tx buffer is to remove jitter or slips from the input signal. The clock input for the transmit buffer is provided from the Tx buffer clock gate. This gate is provided to either invert or not invert the transmit clock to the buffer. The selection of whether to invert or not depends upon the length of cable used from the DTE to the modem and the transmit clock option selected. The Tx buffer clock gate receives the transmit clock from the Tx buffer clock multiplexer, whose inputs are either the transmit timing (TT) (or transmit clock, Tx clock) or the transmit clock option PLL, which is also SCT/ST.

The data output (DO) of the transmit buffer is provided to the modulator through Expansion Mux A. The transmit buffer output clock (CO) is also supplied to the modulator. The CO clock is provided from the Tx clock option PLL.

The transmit clock option PLL provides the SCT/ST clock output to the data interface. This signal is always provided at the data rate selected.

The input to the transmit clock option PLL is provided by the Tx option multiplexer whose inputs consist of:

a. the station clock;
b. the TT (transmit timing) or transmit clock;
c. the internal 12.425 MHz clock; and
d. the receive clock (or RT clock).

Transmit clock option selection thus consists of choosing (a) the source for the transmit clock option PLL, (b) the source for the Tx Buffer clock, and (c) the inversion of the Transmit Buffer clock signal.

The demodulator provides the RCLK and RDATA signals to the M&C board. The RDATA and RCLK signals are provided to the receive buffer data input (DI) and clock input (CI) through expansion multiplexers C and D. The receive buffer is used to remove jitter in the received signal as well as any Doppler effect.

The RCLK signal is also routed to the Rx option multiplexer for the Rx clock option PLL. This multiplexer is connected to four input signals:

a. the receive clock (RCLK);
b. the station clock;
c. the internal 12.425 MHz clock; and
d. the transmit clock (TT).

The Rx clock option PLL smooths the selected input to remove jitter. The output of this PLL is routed to the Rx buffer clock multiplexer along with the RCLK signal and the SCT signal from the Tx clock option PLL. The selected input from the Rx buffer clock multiplexer is provided to the clock out (CO) input of the receive buffer, as well as to the input of loopback multiplexer C. The output of loopback multiplexer C is the receive clock signal (RT) and is then provided to the data interface.

The data out (DO) from the receive buffer is routed to the bypass multiplexer. In the bypass mode, this multiplexer selects the RDATA signal to be presented to the data interface. When not bypassed, this multiplexer selects the receive buffer data output (DO) for the interface.

Receive clock option selection thus consists of (a) choosing the source for the Rx clock option PLL, (b) choosing the source for the receive buffer output clock, and (c) choosing the receive buffer or bypassing. The choice of the receive buffer output clock is made automatically by the modem based on the buffer bypass selection.

Figure 3-1 also indicates the action of loopback. In the loopback mode, the transmit data (SD) is routed to receive data (RD). The output of the bypass multiplexer is routed to the transmit buffer data input (DI) through loopback mux A. Transmit timing (TT) is routed to receive timing (RT) through loopback mux C. If TT is the selected transmit reference, loopback mux B replaces it with the receive buffer output clock. Thus, data and clock from the DTE is looped back to the DTE, and the modem portion provides a remote loopback over the satellite using the receive data and clock as the transmit data and clock.

3.3 Transmit Options

Three steps are required to set up the transmit clock options:

1. choose the transmit buffer clock source,
2. choose the inversion of the transmit buffer clock source, and
3. choose the transmit clock PLL source.

The selection of the transmit buffer clock source will usually depend on the DTE requirements. If data is being provided without a clock, then the selection of the transmit clock option PLL (SCT) is correct. Then, depending on the time delay and resultant phasing of the data stream, the choice as to whether or not to invert the clock must be made. An improper choice will result in inverted data at the receiving demodulator.

If the data is being provided without a clock, two options exist for the selection of the transmit clock option PLL source. The station clock may be used, or the internal clock may be used. In either case the PLL will provide a clock signal at the data rate for use by the transmit buffer and the modulator. First, the station clock input may be any multiple of 3.2 KHz or 4.0 KHz from 9.6 KHz to 10.0 MHz. The M&C will adjust the PLL for an output at the data rate. Second, the internal clock may be used. The internal clock is a 12.425 MHz signal with an accuracy of ±2.5 ppm. In either of these cases, the PLL provides an SCT/ST signal to the data interface at the data rate.

If the DTE is providing the data and it is desired to use the modem as the source of timing, the SCT/ST signal from the interface is used by the DTE to synchronize the data. The data is then provided to the modem either with or without the return clock. If the data is provided without the return clock, then the choice for the transmit buffer clock source is SCT (the PLL). The buffer clock invert control must be established based on the phasing of the data. The source for the transmit clock option PLL may be (a) the station clock, (b) the internal clock or (c) the receive clock. Choices (b) and (c) are not recommended for this mode, but will function if selected. Function, however, does not infer that operation will be acceptable.

If the return clock is provided by the DTE, then the appropriate selections are to choose not to invert the transmit buffer clock, choose TXC (transmit clock) as the buffer clock source, and one of three sources for the transmit clock option PLL. The three sources may be (a) the station clock, (b) the receive clock, (c) the internal clock. The selection of TXC for the transmit clock option PLL source is invalid in this case.

Normal operations are such that the DTE is sourcing both the data and the clock. In this case, the proper selections are to not invert the Tx buffer clock, select the SCT as the Tx buffer clock source, and select TXC as the Tx clock option PLL source.

3.4 Receive Options

Two steps are necessary to set up the receive clock options:

1. choose the receive buffer or bypass; and
2. choose the receive clock option PLL source.

As previously mentioned, the selection for the receive buffer output clock is made automatically by the modem based on these two choices.

In the figure, the connection between the Tx clock option PLL (SCT) and the Rx buffer clock multiplexer is provided for future considerations. Thus, the control of both the Rx buffer clock multiplexer and the bypass multiplexer is identical and is based on whether or not the Rx buffer is bypassed. If the Rx buffer is bypassed, then the clock and data from the demodulator are provided to the data interface. If the receive buffer is selected, then the remaining clock options apply.

The output of the Rx clock option PLL is always at the receive data rate. The M&C board programs the PLL to accommodate the rates presented by the input multiplexer. The four choices of source for the PLL are: (a) the station clock, which may be any multiple of 3.2 KHz or 4.0 KHz from 9.6 KHz to 10.0 MHz, (b) the internal clock,

(c) the transmit clock (TT), or (d) the demodulator output clock RCLK. The use of (b) is not recommended; the use of (a) requires cooperative station clocks between the modulator site and the demodulator site, and is not generally recommended.

Normal operation of the modem has the buffer enabled, and the source for the Rx Clock Option PLL chosen as RXC, the demodulator clock.

3.4.1 Special Conditions

The above discussion has centered on the common possibilities for clock option selection. There are two selections which are automatically locked out, or disallowed, by the modem. It is not possible to choose the reference for the transmit to be the receive clock AND the reference for the receive to be the transmit clock, or vice-versa. These conditions, in particular, are locked out. Other conditions are not locked out to provide the maximum flexibility in the use of the clock options.

3.4.2 General Instructions

Before placing the modem in service, it is possible that operational parameters will need to be modified. The next section presents a detailed overview of the configuration parameters for the SM2800. Before attempting to program these parameters, a complete review of the next section is recommended.

3.5 Configurable Modulator Parameters

Modulator Frequency – The modulator is provided in either the 70 MHz configuration or the 140 MHz configuration. For the 70 MHz configuration, the modulator may be programmed for any frequency between 52.0000 MHz and 88.0000 MHz in an increment of 2.5 KHz. For the 140 MHz configuration, the modulator may be programmed for any frequency between 104.0000 MHz and 176.0000 MHz in 2.5 KHz increments.

Modulation Type – The modulator may be programmed for either BPSK modulation or QPSK modulation.

Modulation Encoding – The modulator may be programmed for 1/2 rate or 3/4 rate, K=7 Viterbi or sequential.

Transmit Data Rate – The modulator data rate may be programmed between 9.6 Kbps and 512 Kbps, depending on the combination of modulation and code rate. The following presents the valid selections:

Code Rate 1/2			Code Rate 3/4		
Data Rate Kbps	BPSK	QPSK	Data Rate Kbps	BPSK	QPSK
9.6	√				
12	√				
16	√				
19.2	√				
24	√				
28	√				
32	√	√			
38.4	√	√			
48	√	√	48		√
56	√	√	56		√
64	√	√	64	√	√
96		√	96	√	√
112		√	112	√	√
128		√	128	√	√
192		√	192	√	√
224		√	224	√	√
256		√	256		√
384		√	383		√
448		√	448		√
512		√	512		√

Other special data rates are available from the factory. Inquiries are invited.

Modulation Rotation – The modulator may be programmed for either normal or reverse rotation. This command is used when dissimilar conversions in up and downconverters are used. For example, if the upconverter uses a low side injection for its mixer process and the down converter uses a high side injection, the modulation at one end is reversed in rotation with respect to the other end. In this case, either the modulator or the demodulator rotation needs to be reversed.

Power Level – The modulator output power may be programmed from -5.0 to -25.0 dBm in steps of 0.5 dB.

Carrier State at Power Up – The modulator may be programmed to return to its previous transmitter on/off state upon the reapplication of power, or OFF.

Scrambler –The scrambler may be programmed for one of four choices: (a) V.35 (CCITT), using the energy dispersal algorithm specified by CCITT, (b) V.35 (Intelsat), which uses the energy dispersal algorithm given in Intelsat IESS-308 (and is referred to also as "FDC"), (c) Linkabit compatible, which uses the energy dispersal algorithm introduced by Linkabit Corp., or (d) OFF, in which case no scrambling is performed on the input data sequence.

Differential Encoder – The modulator may be programmed for the encoder on or off. Normal operation sets the encoder on.

Transmit Power – The modulator transmitter may be placed in its high isolation state (OFF), or may be commanded ON.

Transmit Buffer Clock Select – The data clock presented to the transmit buffer may be chosen to be sourced from the data clock input to the data interface (TT) or from the transmit clock option PLL (SCT). Refer to the above discussion on clock options.

Transmit Buffer Clock Invert – The clock provided to the transmit buffer may be inverted or normal. Refer to the above discussion on clock options.

Modulator Clock Select – The clock source to be used in the modulation process is filtered by the transmit clock option PLL, whose input is defined by this configuration parameter. The selections are: (a) the station clock, (b) the internal clock, (c) the data clock (TXC), meaning the clock provided along with the data to the data interface connector, or (d) the receive clock, meaning that clock selected to clock the receive data out from the receive buffer.

Modulator Mode - The SM2800 is capable of operating in an unframed burst mode. The selections for modulator mode are either continuous or burst.

3.6 Configurable Demodulator Parameters

Demodulator Frequency - The demodulator is provided in either the 70 MHz configuration or the 140 MHz configuration. For the 70 MHz configuration, the demodulator may be programmed for any frequency between 52.0000 MHz and 88.0000 MHz in an increment of 2.5 KHz. For the 140 MHz configuration, the demodulator may be programmed for any frequency between 104.0000 MHz and 176.0000 MHz in 2.5 KHz increments. The demodulator frequency need not match the modulator frequency.

Demodulation Type - The demodulator may be programmed for either BPSK demodulation or QPSK demodulation. The demodulation type need not match the modulation type.

Demodulation Decoding - The demodulator may only be programmed for the installed decoder type. The code rates may be programmed for either 1/2 rate or 3/4 rate.

Receive Data Rate - The demodulator data rate may be programmed between 9.6 Kbps and 512 Kbps, depending on the combination of demodulation and code rate. The tables presented above for the modulator are valid for the demodulator. The demodulator decoder type, data rate and code rate need not match the modulator encoder, data rate and code rate.

Demodulation Rotation – The demodulator may be programmed for either normal or reverse rotation, independent of the modulator.

Differential Decoder – The differential decoder may be commanded on or off. The normal condition is the decoder on.

Demodulator Descrambler – The descrambler may be programmed for one of four choices: (a) V.35 (CCITT), using the energy dispersal algorithm specified by CCITT, (b) V.35 (Intelsat), which uses the energy dispersal algorithm given in Intelsat IESS-308 (and is also referred to as "FDC"), (c) Linkabit compatible, which uses the energy dispersal algorithm introduced by Linkabit Corp., or (d) OFF, in which case no descrambling is performed on the input data sequence. Scrambler and descrambler off are suggested only for test conditions.

Receive Buffer Clock Select – The clock source to be used in the output clocking of the receive buffer is filtered by the receive clock option PLL, whose input is defined by this configuration parameter. The selections are: (a) the station clock, (b) the internal clock, (c) the transmit data clock, meaning the clock provided along with the data to the data interface connector, or (d) the receive clock, meaning that clock derived by the demodulator in extracting the data sequence from the received signalling.

Receive Buffer Bypass – The receive buffer may be commanded ON or OFF. The normal condition is for the receive buffer to be ON.

Receive Buffer Size – The size of the receive buffer may be selected to be 0 to 8 kilobits, where 1 kilobit = 1024 bits. The selection of 0 causes buffer bypass. The required size of the buffer is dependent upon the data rate and the satellite fade rate.

Rx Offset - The Rx frequency is programmed in KHz from 0 to 99.9 KHZ in 100 Hz steps. Acquisition attempts occur at the programmed demodulator frequency ±the Rx frequency offset. This parameter can be used to compensate for any known system variations while maintaining the desired frequency parameter.

Sweep Width - The acquisition sweep width (end-to-end) is programmed in KHz, ranging from 0 to 99.9 KHz in 100 Hz steps. This can be used to significantly reduce signal acquisition time by reducing the size of the sweep width. Care must be taken to ensure that the signal still falls within the sweep range. In general, sweep widths of less than 3 KHz are not recommended. If the sweep width is set to zero, then no sweep will occur.

Sweep Timer - The sweep timer is a time value programmed in seconds ranging from 0 to 999. After losing lock and after the specified amount of time has passed without reacquisition, all tracking values are reset to the frequency originally commanded. The tracking values are also reset whenever the demodulator frequency, offset, or sweep width are reprogrammed.

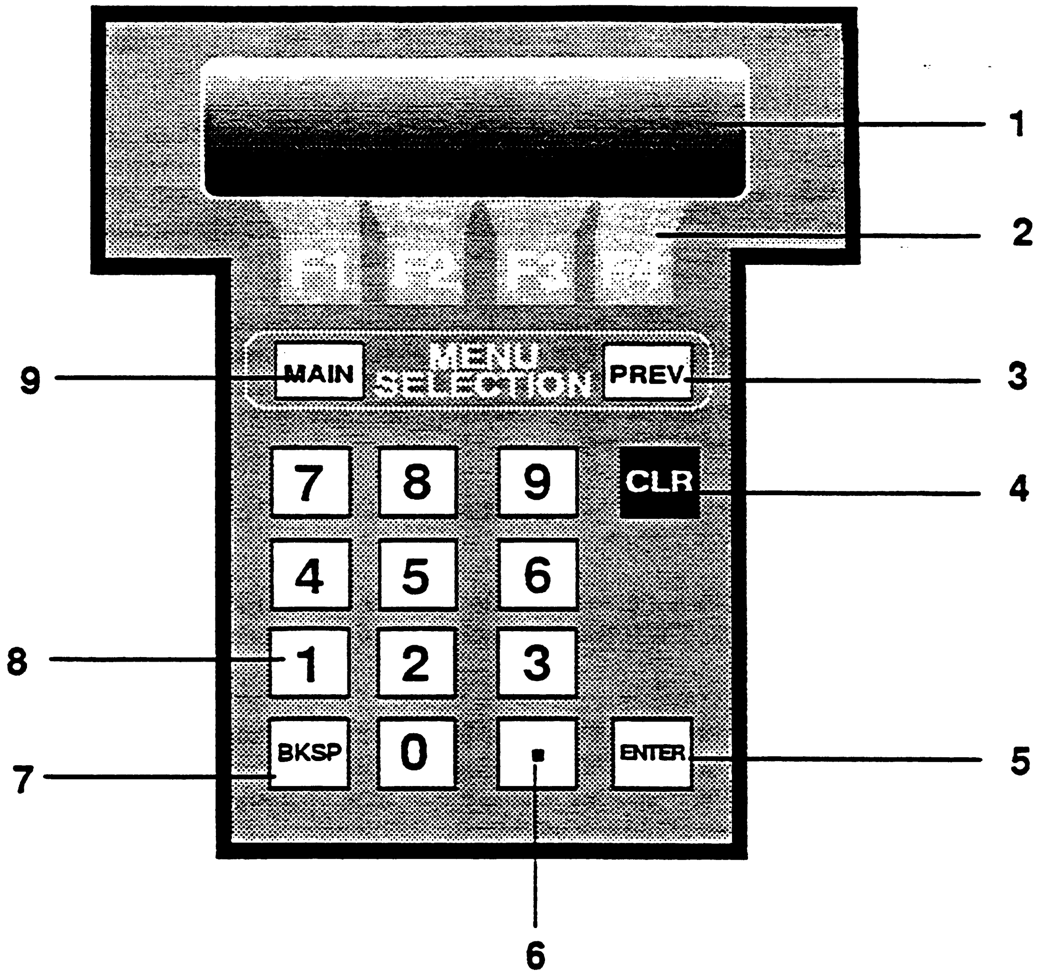
> **CAUTION**
> Modems with version 1.03 firmware contain an anomaly which disables carrier tracking when the timer value is set to zero. Later versions effectively prevent this. Also, later firmware versions treat 999 seconds as 'infinite' and as such, tracking values are not reset regardless of the amount of time that has elapsed since the signal has lost lock.

3.7 Configurable M&C Parameters

Station Clock Select – The station clock may be selected to use either the RS422 input from J6 or the BNC input from J7.

The station clock rate may be selected to be any multiple of 3.2 KHz or 4.0 KHz from 9.6 KHz to 10.0 MHz.

The system modes are controlled through the loopback and test commands. If loopback is disabled, then the system is in the normal mode. Normal mode means that data from the DTE is directed to the modulator and data from the demodulator is directed to the DTE.



Handheld Terminal Item Descriptions

1. 4-Line LCD display for monitoring configuration and command.
2. Function keys 1 through 4 which permit selection of items from the display located directly above each key.
3. PREVIOUS key which allows exiting from the current menu level and returns to the previous menu level.
4. CLEAR key allows the keypad entry to start over.
5. ENTER key executes or implements the command upon completion of the command entry. Enter must be depressed to accept or execute a parameter.
6. Decimal point for numeric entry.
7. BACKSPACE key clears the last entry and allows re-entry.
8. Numeric keypad allows entry of numeric parameters such as frequency or power.
9. MAIN menu which is the root menu of the menu tree.

Figure 3-2. Handheld Terminal

Loopback means that the data from the DTE is directed to the DTE, and receive data and clock is directed to the modulator.

The test mode may be enabled at any time. When test mode is enabled, the modem will display the test LED on the M&C board. While in the test mode, constant carrier may be commanded to allow inspection of the carrier center frequency.

The SM2800 is unlike other modems in that there are no configuration jumpers for the host interface baud rate, parity, etc. However, these parameters are field changeable through any of the provided serial interfaces. Should any of these parameters be changed, care must be taken to assure that the host parameters themselves are changed to correspond with the modem. The same comments apply to the device address setting. Refer to Appendix B for additional details.

As an aid to establishing the modem configuration, a configuration worksheet is provided in Table 3-1.

3.8 Using the Handheld Terminal

Configuring the SM2800 may be performed with the optional handheld terminal. Refer to Figure 3-2 for a brief explanation of the controls.

Installation of the handheld terminal is performed after all modules have been installed in the chassis. The front panel thumbscrews should be released and the front panel lowered. On the right side of the M&C board, a single RJ-11 jack will be found. The pin-out of this connector is as follows:

Pin 1	Signal Ground	
Pin 2	Tx Out	RS232 Transmit Output
Pin 4	+5V	External Unit Power
Pin 5	Rx In	RS232 Receive Input

The mating connector at the end of the handheld terminal cable is inserted directly into this connector. The installation is complete, and the handheld terminal may be removed after the unit is configured, if so desired.

Control using the handheld terminal is menu driven and utilizes the soft function keys F1-F4 to select menu items until the desired parameter is attained. In the control mode, the user is prompted by a question "CHANGE TO?" or "NEW?", and can change the parameter by entering the desired choice as defined by F1 through F4, or a number using the numeric keypad. In either case, a command is not executed until the ENTER key is pressed. The display will then confirm that the new choice has been made and prompt the user for selection.

To go to another level of the menu tree, the MAIN and PREV keys can be depressed. MAIN returns the user to the root menu, while PREV backs the menu display up by one level.

A full outline of the menu tree is presented in Figures 3-3 through 3-5. This tree may be used to prevent trial and error in seeking specific parameter menus.

NOTE

Fairchild Data Corporation is continually reevaluating and improving product features and performance. FDC reserves the right to provide additional menu selections without notice. As a result, the menu depicted herein may not exactly match the implementation of the units delivered with this manual. Changes to the manual will be incorporated when major operational differences exist.

A list of the abbreviations and associated functions displayed on the menus is presented in Table 3-2.

Configuration of the modem always begins from the root menu of the tree, and is identified by the message "The SM2800 ..." appearing on the display. If it is not in view, press the M key. The first two menu subtitles appear directly above the F1 and F2 keys, and are CHK and PROG.

Hand-held Terminal Menu Threads

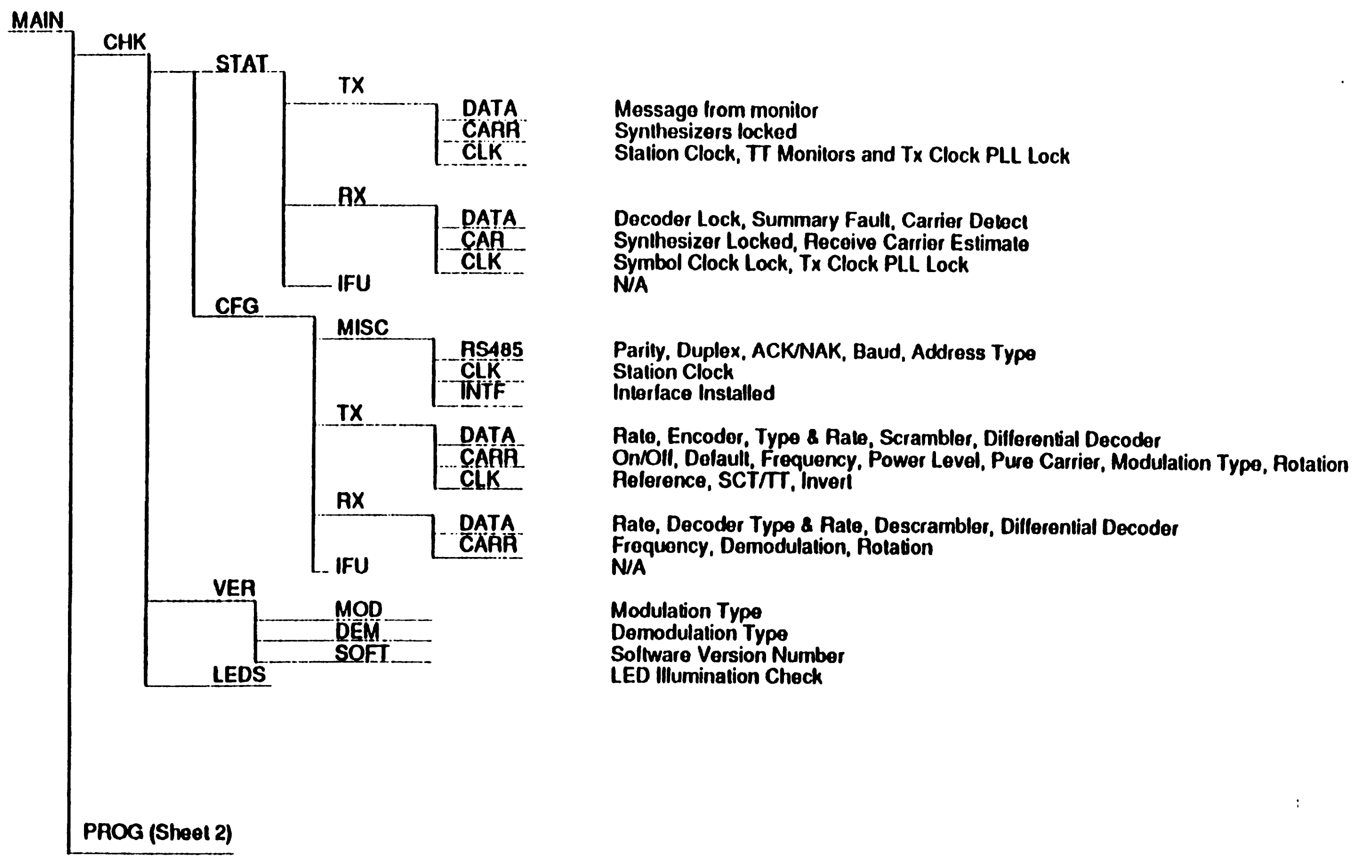


Figure 3-3. Handheld Terminal Menu Threads

Hand-held Terminal Menu Threads (Continued)

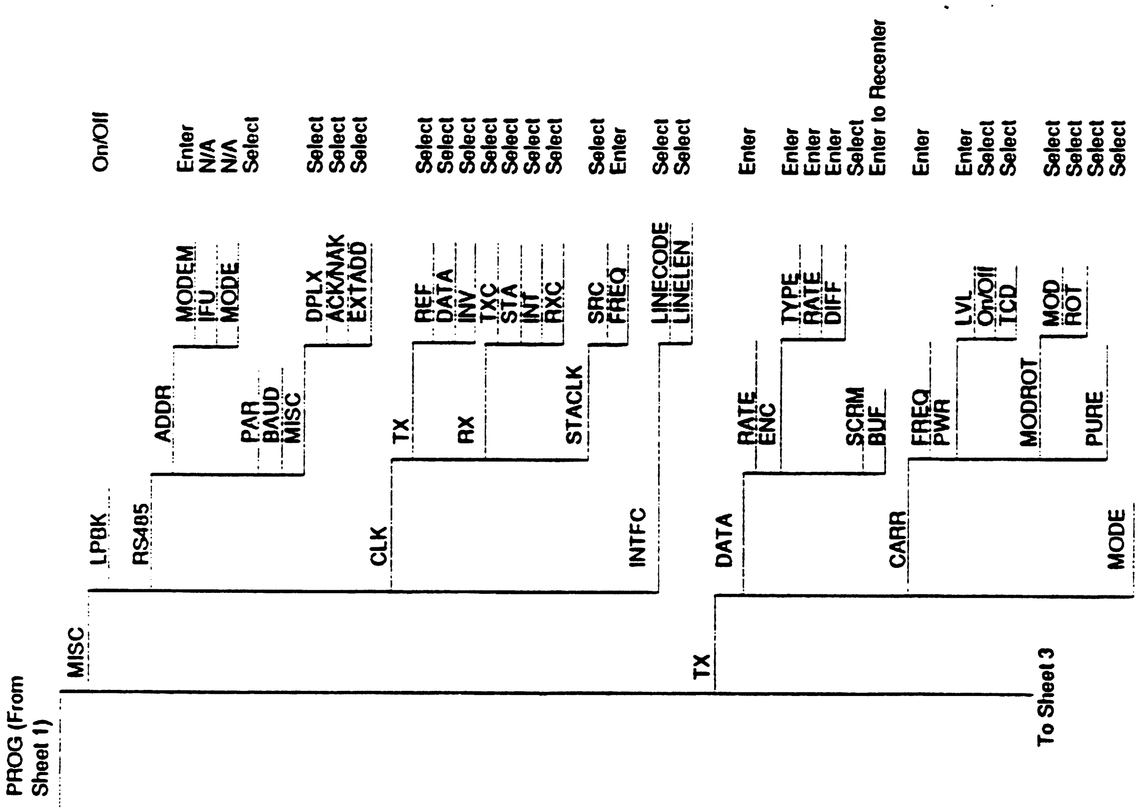


Figure 3-4. Handheld Terminal Menu Threads

Hand-held Terminal Menu Threads (Continued)

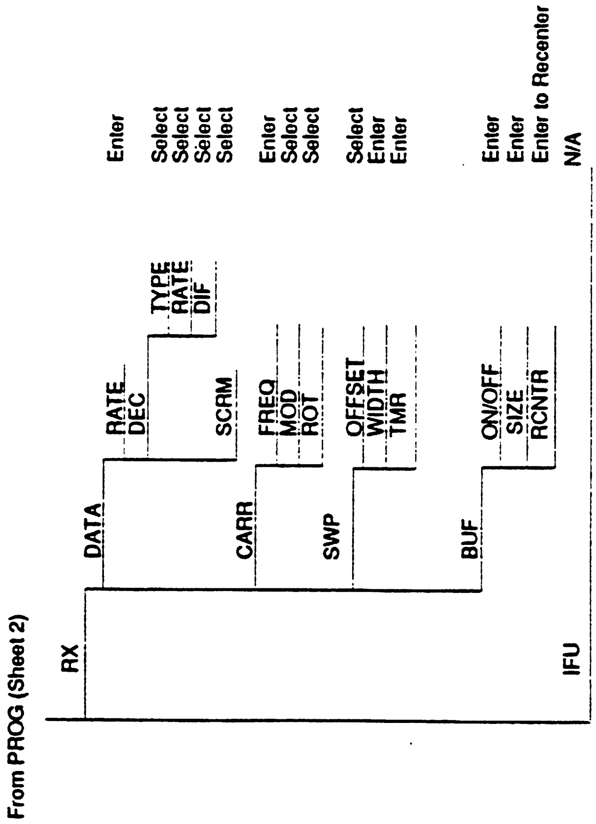


Figure 3-5. Handheld Terminal Menu Threads

MOD	Modulation	Menu subtitle leading to checking or programming the modulation type
MOD ROT	Modulation Rotation	Menu subtitle leading to programming the modulator or demodulator signal rotation
MODE	Mode	Menu subtitle leading to programming the transmit mode, burst or continuous
MODEM	Modem	Menu subtitle leading to programming the host address
NM SYN	Narrowband Synthesizer	Status message prefix for the modulator narrowband synthesizer
NORM	Normal	Status message, configuration or programming value for the normal value of the parameter in the prior subtitle
ODD	Odd	Menu selection for the configuration or status message of the host interface parity
OFF	Off	Menu selection or status message of a parameter identified in the prior menu subtitle
OK	All right, okay	Status message recognizing that the prefix parameter is within monitor bounds
ON OFF	On or Off	Menu subtitle leading to the programming of the state of the transmitter or the receive buffer
PAR	Parity	Menu subtitle leading to the programming of the host interface parity
PLL	Phase Locked Loop	Status message prefix
PROG	Program	Menu subtitle leading down into other subtitles for the programming of parameters
PURE	Pure Carrier	Menu selection for enabling the transmission of a pure carrier. The selection is activated only in the test mode.
PWR	Power	Menu subtitle leading to the programming of the transmit power output level
QPSK	QPSK Modulation	Menu selection item causing the modulator or demodulator to process QPSK signals
RATE	Rate	Menu subtitle leading to the programming of a rate value for the parameter indicated in the prior subtitle
SYN	Synthesizer	Status message prefix for the condition of the synthesizer
TCD	Transmit Carrier Default	Menu subtitle leading to the programming of the transmit carrier default; see LST and OFF
TT	Transmit Timing	Status message prefix for the state of the TT monitor
TX	Transmitter	Menu subtitle leading to additional menus for the programming or checking of modulator parameters

TXC	Transmit Clock	Menu selection for clock options, indicating that the parameter identified in the prior subtitle should use the SCT source as its reference
UNC	Uncoded	Menu selection for uncoded operation
UNLOCKED	Unlocked	Status message indicating the state of the prefix monitor
UP	Up	Menu selection causing a selection list to increase for viewing
V.35	V.35	Menu selection for the programming of the scrambler or descrambler type in the modulator or demodulator
VER	Version	Menu subtitle leading to additional selections for the versions of modules installed
VIT	Viterbi	Menu selection for the modulator to use the encoding method for the Viterbi algorithm
WB SYN	Wideband Synthesizer	Status message prefix for the state of the wideband synthesizer monitor in the modulator

3.9 USING 'HANDHELD' PROGRAM (FDC P/N 006183-904)

'HANDHELD' is a computer program developed for the IBM PC and compatibles. The program exactly emulates the operation of the handheld terminal. To use this program instead of the handheld terminal itself requires a minimum configuration PC, as detailed in Section 3.1, plus a cable adapting the selected COMM port of the PC to the RJ-11 connector for the Handheld Terminal. The pinout of the RJ-11 connector is given in the previous section. Upon construction or purchase of this cable, connect the cable between the selected PC COMM port and the RJ-11 jack of the modem. Again, the connector is located at the right side of the M&C board. Refer to Appendix A for PC Cabling information.

The program itself may be operated from the floppy disk provided (FDC P/N 006182-901), or may be copied onto a hard drive for more permanent storage. The program is invoked by simply typing HANDHELD followed by ENTER or RETURN.

The program initially requests the information as to which COMM port of the PC is attached to the modem. Answer with the number 1 through 4, corresponding to the COMM port to which the cable is attached. The program then displays a diagram of the handheld terminal, and configuration programming then proceeds identically with the menu steps and keystrokes of the last section.

3.10 USING 'SM2800' PROGRAM (FDC P/N 006184-904)

The program 'SM2800' is provided with the modem on the same disk as the 'HANDHELD' program. 'SM2800' is a windows application that must be run from inside the Microsoft Windows™ environment.

'SM2800' is a full-feature control program that allows the user to:

- Configure the PC COMM ports;
- Load and save modem configurations from disk files;
- Print the current modem configuration;
- Configure any parameter of the modem;
- Monitor the modem performance in a snapshot or polling mode; and
- Search for lost host addresses.

When used with external RS232/485 adapters, the software may be used to control and monitor up to 32 modems, thus assisting in the management of racked installations. When used with the standard PC COMM ports, which

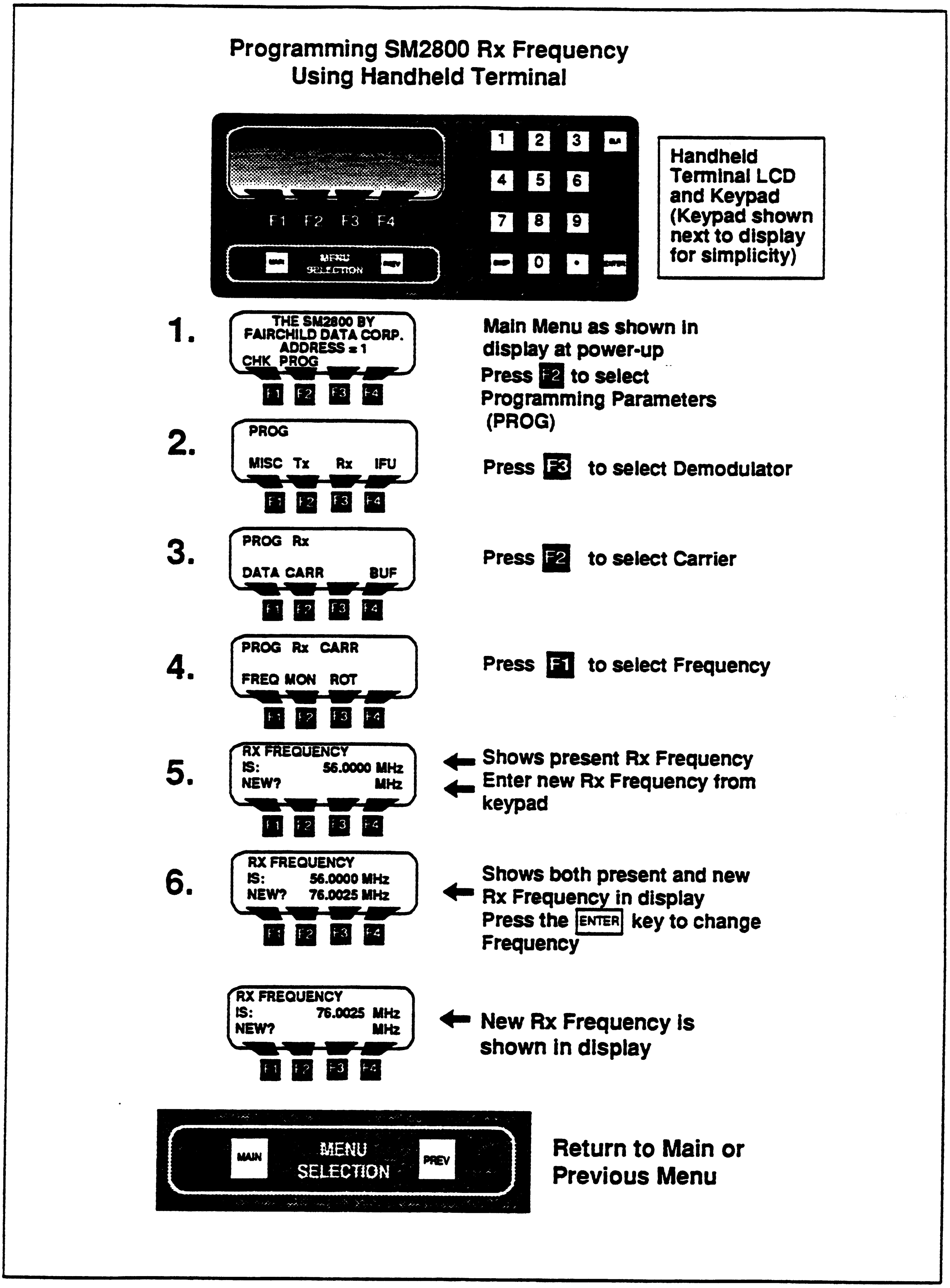


Figure 3-6. Programming SM2800 Rx Frequency Using Handheld Terminal

Appendix A – PC Cabling Information

\.1 PC Connections for the "Handheld" program

'o use the "Handheld" program, it is necessary to interface the PC to the RJ11 connector of the SM2800. This equires the connection of the PC serial port to modular telephone cable with an RJ11 jack at one end. Two options xist for providing this cabling; (1) Using commercially available adapters and cable, and (2) Constructing adapters ınd cable.

\.1.1 Option 1. Commercially available

'he necessary materials may be purchased from Black Box Corporation, PO Box 12800, Pittsburgh, PA, 15241, JSA; (412)746-5530.

'he needed materials are:

DB25-RJ11 adapter: P/N FA018
RJ11 cable - 4 ft: P/N EL04MS-04
or 7 ft: P/N EL04MS-07

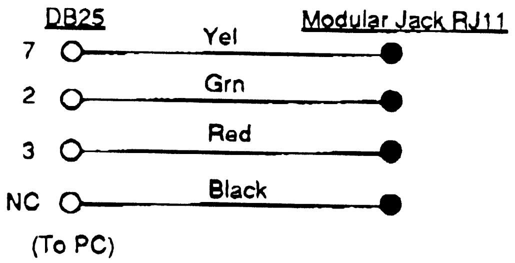
'he FA018 adapter must be modified as follows: Open the adapter by removing all screws. Cut the connections ı the approximate center of the wires. Rewire by splicing the cuts as follows:

DB25 side	RJ11 Side
2	Green wire
3	Red wire
7	Yellow wire

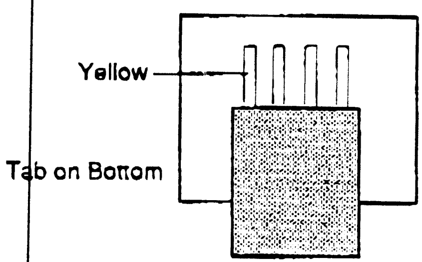
ıfter splicing the cuts, reassemble the adapter.

\.1.2 Option 2. Construction

'he adapter is not required to be constructed. The cable is constructed instead by wiring standard 4-wire elephone cable to a DB25 connector at one end and crimping a modular RJ11 jack at the other end. The wiring iagram for the cable is as follows:



lease note that the modular plug is crimped to the cable with the yellow lead located to the left of the tab, as follows:



.1.3 PC Connections for the SM2800 program

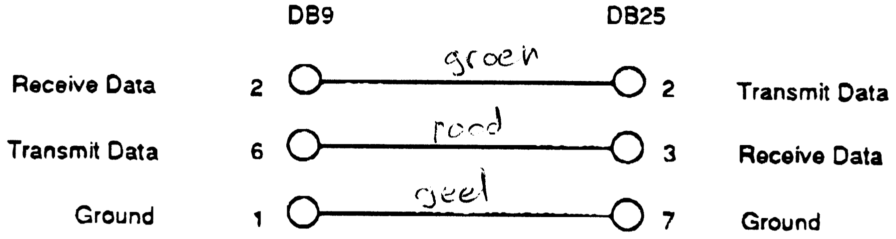
he user must first decide if the program is to be used with the RS232 (point-to-point) modem connection or with ıe multipoint RS485 connection. In review, the RS485 connection will allow placing multiple modems on a single ȷs and controlling or reconfiguring the modems. For initially configuring modems, either the RS232 connection

[redacted]

or the 485 connection may be used, but using RS485 requires that only one modem be on the bus until its host address is changed to a unique number. (Reminder - all modems are factory preset to host address 001).

A.2 Providing the RS232 Connection

The required cable needs to be constructed using a DB25 female connector and a DB9 male. The user is free to choose the wire to be used consistent with the connector purchased. The connection diagram is presented below:



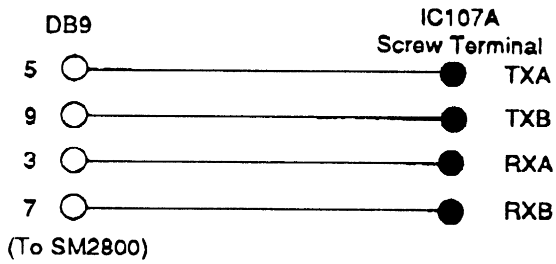
The DB9 side is connected to the SM2800 J9, while the DB25 side is connected to the PC serial port chosen.

A.2.1 Providing the RS485 connection

The RS485 connection is best provided by commercially available equipment, which converts the RS232 signals from the PC to RS485. The necessary materials may be purchased from Black Box Corporation, PO Box 12800, Pittsburgh, PA, 15241, USA; (412)746-5530. The needed materials are:

RS232/RS485 Interface Converter, P/N IC107A
DB25/DB25 Male/Female Cable, P/N EVNBSM

One additional cable needs to be constructed. This cable contains a DB9 male connector at one end and is stripped and tinned at the other end. Wire may be of the users choice, consistent with the DB9 connector requirements. This cable is connected to the IC107A as follows:



The other end is connected to the SM2800 J9 or J10. (Reminder: The RS485 bus must be terminated at both ends.)

The W15 jumper in the IC107A is set to the BC position and the dip-shunt jumper should be placed in socket XW1A, in accordance with the Manufacturer's manual. It is recommended that the IC107A be placed at one terminating end of the RS485 bus, and that SW2 of the IC107A be placed in the "TERM" position.TXA

A.3 PCs using a 9-pin RS232 port

Some PCs use a 9-pin version of the serial port, which contains the functionality of the RS232 connector but in a 9-pin shell. If the PC in use possesses this kind of connector, the references in the above sections which refer to the DB25 connector require an additional adapter. The adapter is commercially available from Black Box Corporation, PO Box 12800, Pittsburgh, PA, 15241, USA; (412)746-5530. The adapter part number is FA520.

SECTION 1 - GENERAL DESCRIPTION

1 INTRODUCTION

ıe Fairchild Data Corporation SM2900 PLUS Satellite odem incorporates all of the features of the previous ⁄12900 Satellite Modem, but expands the capabilities by :tending the 2304 Kbps upper data rate limit of the evious SM2900 to the E2 data rate of 8448 Kbps. This accomplished with the incorporation of a new modulator ıd demodulator, changing the M&C control firmware for mpatibility with the new modulator and demodulator, ıd upgrading the optional Internal Framing Unit (IFU) to ıerate at the T2 and E2 data rates as specified by IESS-8. By installing a plug-in Nyquist filter assembly on the w demodulator, two data rates above the agile data rate ıge of the SM2900 are added. To provide all those who rchase the SM2900 modem the capability to upgrade ' high data rate operation, Fairchild has changed the ›duction of SM2900 modems to use the new modulator d demodulator board set. This manual documents both ፧ 'New' SM2900 and the SM2900 PLUS, as the only ıctional difference between the two modems is whether not the high data rate is enabled with the installation of ፧ Nyquist filter plug-in assembly on the demodulator. roughout this manual, the modem is referred to as 12900 PLUS. Section 1-6 of this manual further dis-ꜱses the SM2900 modem configuration.

SM2900 PLUS Satellite Modem Features

- Internal Framing Unit; IBS/IDR
- Programmable Data Rates and Code Rates for Symbol Rates up to 6312 KHz
- Modulator Data Rates In One Bps Increments to 4096 Kbps and Two Bps to 8448 Kbps
- Demodulator Data Rates in One Bps Increments to 2304 Kbps, Plus Two Fixed Rates up to 8448 Kbps
- Programmable Receive Buffering
- QPSK Modulation with Sequential or K=7 Viterbi Decoding
- Full Remote Control with Non-Volatile Configuration
- 3-1/2 Inches (2U) High
- Universal 110/220 AC Power Supply

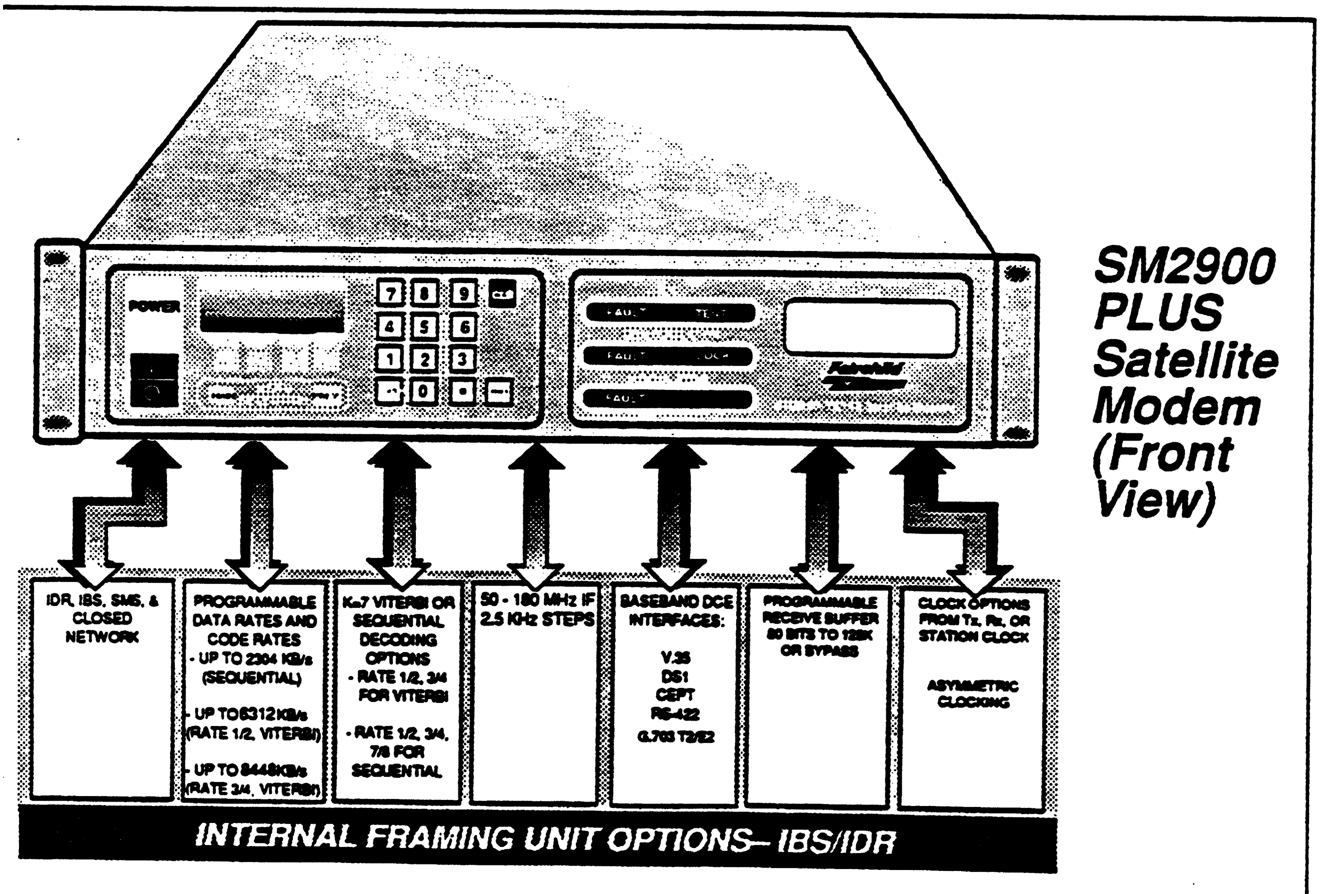


Figure 1-1. SM2900 PLUS Features

1.2 MONITOR AND CONTROL (M&C)

The SM2900 M&C provides command and status of the unit and permits either local or remote control. Local control of the SM2900 is executed via a front panel LCD and keypad. This includes function keys that indicate the available selections and guide the operator through the unit's settings. An RS485 bus is supplied for the remote control of the SM2900 which provides full monitoring and control capability.

1.3 CLOCKING OPTIONS

The SM2900 provides the most flexible set of clocking options in the industry. This includes independent clocking operation of the Tx and Rx sections or using the Tx clock, Rx clock or a station clock as the reference for the SM2900. In addition, asymmetric clocking and referencing in one bit-per-second increments is possible with the SM2900. For example, the Tx clock can be used as the reference for the unit at 64 Kbps and the Rx clock may be locked to the Tx rate and operate at 200.001 Kbps.

Additionally, the SM2900 has a receive buffer programmable in 8-bit increments to cover all standard open network framing requirements and to provide flexible buffer settings for any type of network.

1.4 INTERNAL FRAMING UNIT (IFU) AND ENGINEERING SERVICE CHANNEL (ESC)

The IFU provides the overhead framing required for IBS, IDR and ECS/SMS framing. When the companion ESC module is added to the SM2900, it provides access to the 96 Kb IDR overhead which includes the voice channels, data channel and backward alarms.

1.5 KEYPAD AND DISPLAY

The Liquid Crystal Display (LCD) and keypad are located on the SM2900 front panel and provide the local control and status of the modem. LEDs on each module indicate summary fault and test conditions of the modem. The control of the modem is accomplished using a 'soft' key menu for ease of operation (See Figure 1-2).

1.6 SM2900 CONFIGURATION

The modulator and demodulator assemblies in the SM2900 have been enhanced from the original design. The new assemblies give the user the capability of upgrading the modem to an SM2900 PLUS configuration for operation at data rates above the 2304 Kbps rate 1/2 and 3088 Kbps rate 3/4 limits of the SM2900. Additionally, the demodulator adds the capability of reading the receive carrier frequency and receive carrier level. Although the M&C printed wiring board has not changed, the M&C firmware has been changed for compatibility with the new modulator and demodulator. Table 1-1 summarizes the part number differences for the board assemblies in the 'New' SM2900 versus the 'Old' SM2900. The board assemblies in the 'New' and 'Old' versions of the SM2900 are NOT interchangeable.

Table 1-1. Old and New Part Numbers for SM2900 Board Assemblies

Assembly	Old P/N	New P/N
Modulator	005297-001	005955-001
Demodulator	005037-001	005973-001
M&C	006031-001	006031-011

When using the RS485 remote control interface, differences will exist in the configuration message and faults as reported by 'New' versus 'Old' SM2900s. The M&C Interface Specification in Appendix B documents the message structures as reported by the new M&C firmware. Remote identification of whether or not the modem is a 'New' or 'Old' SM2900 can be accomplished by checking the software revision. A revision level of 3.0 or higher indicates a 'New' SM2900.

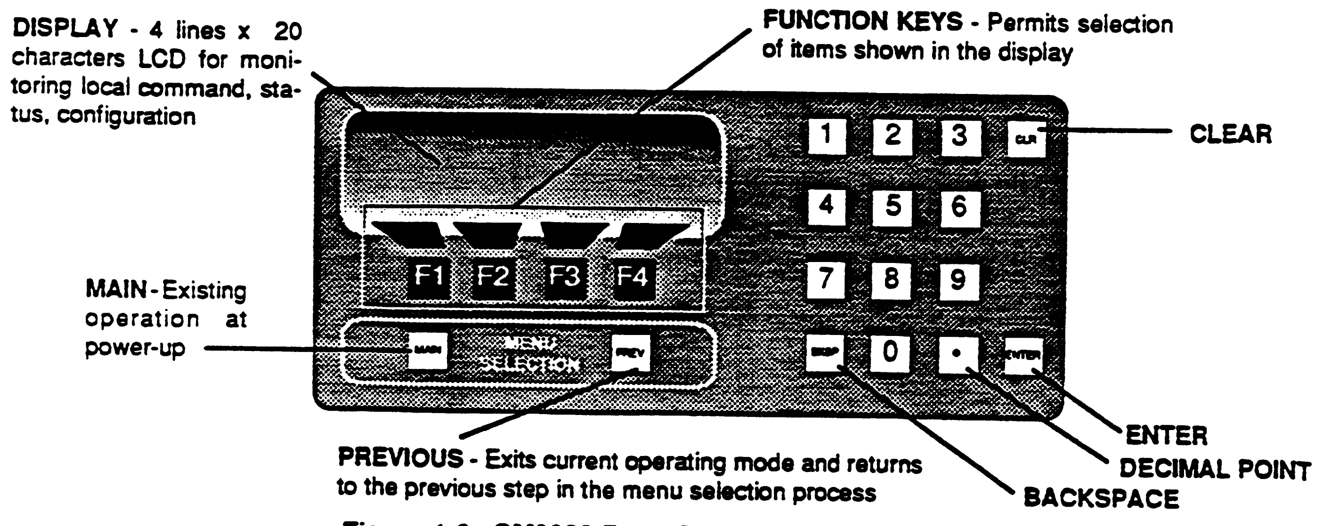


Figure 1-2. SM2900 Front Panel Keypad and Display

.5 KEYPAD AND DISPLAY

ɥe Liquid Crystal Display (LCD) and keypad are located ʌ the SM2900 PLUS front panel and provide the local ɔntrol and status of the modem. LEDs on each module dicate summary fault and test conditions of the modem. ıe control of the modem is accomplished using a 'soft' ɜy menu for ease of operation.

6 SM2900 CONFIGURATION

s introduced in Section 1-1, the board set for the ı2900 PLUS has replaced the previous board set for e SM2900. When the modem is powered-up, the LCD splay on the modem identifies the configuration as ing either SM2900 or SM2900 PLUS, depending upon ıether or not the Nyquist filter plug-in assembly is stalled on the demodulator. In the SM2900 configura- n the data rate range is limited to the one Bps resolution ile range of the demodulator as specified in the Tech- ;al Specifications in Appendix A. Table 1-1 summa- es the part number differences for the board assem- es in the 'New' SM2900 versus the 'Old' SM2900. It should be noted that the board assemblies for the 'Old' and 'New' versions of the SM2900 are NOT interchange- able.

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SECTION 2 - INSTALLATION AND CONFIGURATION

2.1 UNPACKING

NOTE
All cartons and packaging materials should be retained for possible future use.

Inspect shipping containers for damage. If shipping containers are damaged, they should be kept until the contents of the shipment have been carefully inspected and checked for normal operation.

Remove packing list from outside of shipping carton. Open carton and remove contents, checking each item against packing list. Verify completeness of shipment and normal operation. If any item is damaged or parts are missing, notify the manufacturer. If the shipping container is damaged, notify the carrier and the manufacturer. Keep all shipping materials for the carrier's inspection.

2.2 MOUNTING CHASSIS

If the modem is to be rack-mounted, be sure to allow sufficient clearance for proper ventilation, cable connections, and access to controls, as follows:

Chassis Surface	Minimum Clearance
Right and Left Sides	1.5 inches*
Rear Panel	6 inches
Front Panel	30 inches

*Left side (viewed from front): Maintain clear passage for air flow from unit exhaust fan.

2.3 INSTALLING MODULES IN CHASSIS

CAUTION
Handle all modules by edges, never by components. If necessary to lay module down, position with components up. Protect both sides of circuit boards. Modules contain static-sensitive components. DO NOT TOUCH EDGE CONNECTOR TERMINALS.

Figure 2-1 shows the locations of modules in the chassis. All modules must be installed with component side of the board up and in the designated location.

Each module box is marked with module name and serial number, and the chassis is marked with its serial number. Verify that module is being installed in chassis with specified serial number.

2.3.1 Auto-Ranging AC Power Supply

The SM2900 PLUS Power Supply Assembly is already installed in the chassis at the time of shipment. Taking advantage of advancements in power supply technology, the SM2900 PLUS includes an AC power supply that requires no switch settings or wiring changes to cover line input voltage ranging from 90 to 265 Vac.

2.3.2 Power ON/OFF

The ON/OFF switch for the power supply is mounted on the front end of the power supply and is accessible from the front panel of the SM2900 PLUS chassis. Test points for the outputs of the power supply are also accessible from the front panel. The connector for the line input is accessible from the rear of the modem chassis.

No user adjustments are required for the power supply. Consult the factory for power supply replacement or maintenance requirements.

WARNING
The SM2900 PLUS power supply should be serviced only by a qualified technician. Removal of the chassis cover to access the power supply allows exposure to high voltage. The AC or DC line voltage cord must be disconnected from the unit when the cover is removed to prevent exposure to high voltage.

2.3.3 Installing Modules

The modem includes one M&C card, one Modulator card and one Demodulator card for full-duplex operation. To install the modules, proceed as follows:

1. Unpack each additional module and insert into correct slot as shown in Figure 2-1.
2. Press each module firmly into chassis to fully seat rear connectors. Retain all plastic envelopes and packing materials in respective boxes.
3. Verify that all modules provided with chassis have been installed in the correct location.

2.4 INSTALLING INTERCONNECTING CABLES

After all modules are installed in correct slots, install interconnecting cables. All connections to the modem are made at the rear of the chassis to the connectors shown in Figure 2-3. Connector pin-outs are listed in Tables 2-1 through 2-12.

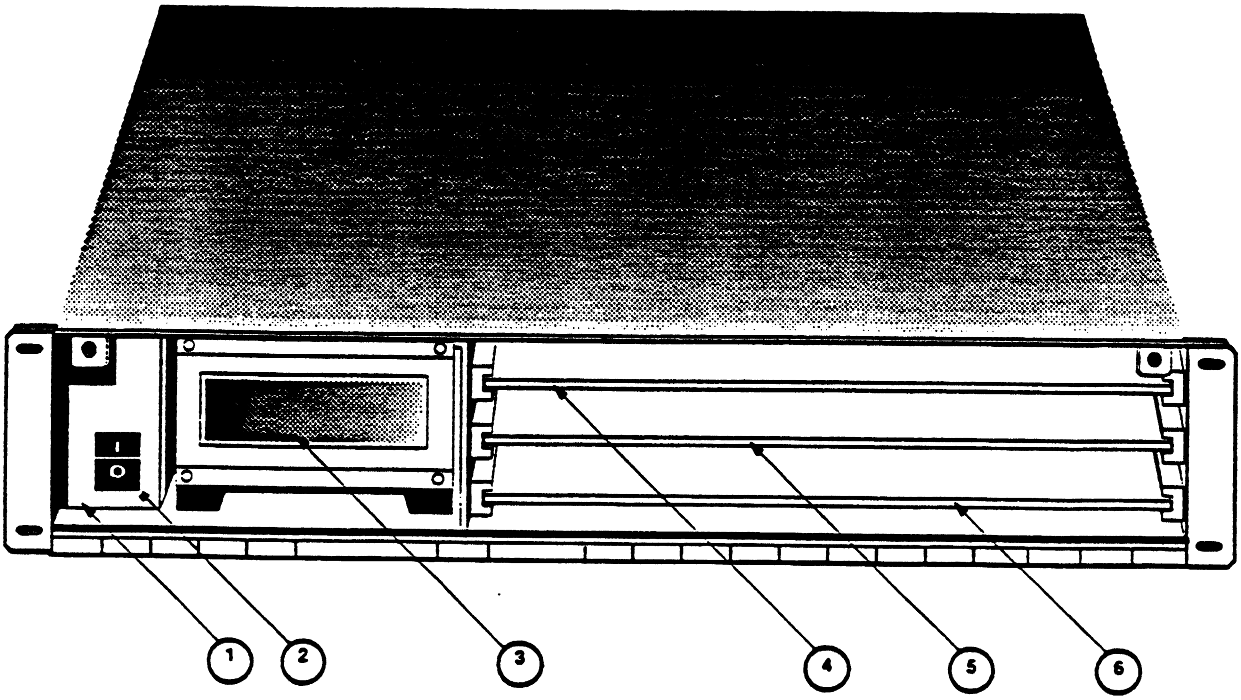
2.4.1 M&C Control and Fault Connector (J10)

The M&C control from an external host is implemented from J10 which contain RS-485 I/O. The cabling must be twisted shielded pairs. The communication protocol for the M&C is described in the **SM2900 PLUS M&C Interface Specification**, Appendix B.

2.4.2 Faults

Separate Form-C contacts are provided for both the Tx and Rx sections of the modem. The normally-open and normally-closed contacts designated in the table are shown for the "unfaulted" condition. The relay will change state when a fault is indicated, including loss of prime power.

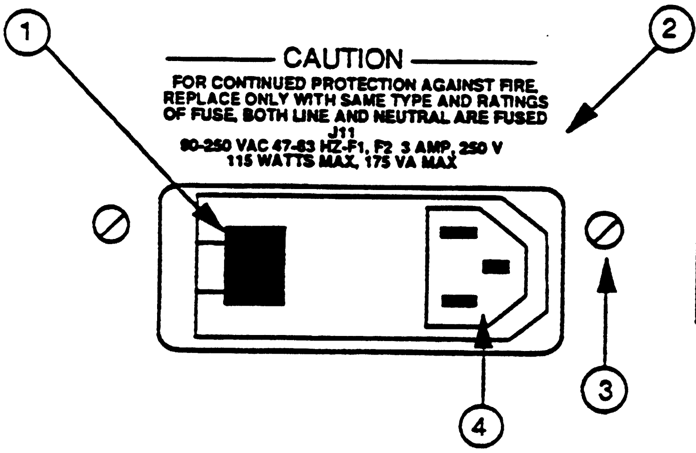
In addition, two TTL open-collector outputs that provide status for Tx and Rx are available. A Lo equals "okay",



LEGEND

1. Auto-Ranging Power Supply Assembly
2. Power ON/OFFSwitch
3. LCD Display
4. M&C/Interface Card (See Figure 2-3)
5. Demodulator Card (See Figure 2-4)
6. Modulator Card (See Figure 2-5)

Figure 2-1. SM2900 PLUS Modules



LEGEND

1. Fuse Location
2. Warning Label
3. End Plate Screws
4. AC Line Filter Connector (J11)

Figure 2-2. SM2900 PLUS Rear Panel Fuse Location and a Hi equals "fault". An external pull-up resistor to +5V is needed as a load for the open-collector faults. The Tx TTL fault line is wired in parallel to the interface module. The Rx TTL fault is wired in the same manner.

2.4.3 Buffer Clock (Buff Clk In, Buff Clk Out)

The Buffer Clock lines are used in conjunction with the M:N Switch for various clocking options. For example, when the Rx Buffer is clocked out by Tx Clock, the Buffer Clock Out signal is a replica of the Tx Clock signal. It is sent to the redundancy switch and returned to the modem's Buffer Clock input which connects to the Rx buffer. In the event the standby unit is required for system backup, the Buffer Clock is routed to the standby unit so that proper clocking of the Rx Buffer is maintained.

2.4.4 MC0C01, MC0C02

These are open-collector outputs which are for future applications, and are not currently available for use.

2.5 M&C CARD, USER-SELECTABLE FEATURES

The M&C Interface Card has a number of user-selectable jumpers and switches which must be set up to properly configure the modem. Figure 2-5 shows the M&C card and indicates the location of the user-selectable items. A discussion of how to set up the configuration is provided in the following paragraphs.

2.5.1 Station Clock Source and Impedance Selection (BNC - J2/RS-422 - J10)

The modem can accept a station clock from one of two sources, (1) J10 RS-422 connector or (2) J2 BNC connector. Note that the connectors are separate and the station clock source is selected by using the menu keys.

The source impedance for the BNC station clock input is either high-impedance (10 K ohms - no load) or low-impedance (75 ohms)using jumpers on the M&C card (See Figure 2-5). The input signal is a square wave with levels 2 to 6V P-P and no DC offset, although TTL/RS422 levels are OK.

The other station clock input is located on J10 and is a balanced RS422 input with an input impedance of either 120 or 3000 ohms selected with a jumper on the M&C card. The input level is RS422 and is designed to interface with the passive clock distribution network provided on the MS298 M:N switch.

2.5.2 RS-485 M&C DCE / DTE Selects, J2

(See Figure 2-5.) Figure 2-5a shows the termination presented by a host used to control the SM2900.

2.5.3 RS-485 Tx / Rx Control Bus I / O Type, J3

This is not currently a user option. The jumper must be placed in the position that provides separate Tx and Rx lines to the M&C Interface.

2.5.4 Decoder Installation

Either a K=7 Viterbi decoder or a sequential decoder is installed on the Demodulator card. The connectors on the decoder mate with J4 and J5, located on the Demodulator card (See Figure 2-7). No adjustments are required. Secure the decoder to the Demodulator card with four mounting screws.

2.5.5 Dual Nyquist Installation

If the demodulator is specified for a symbol rate above 2304 KHz, a dual Nyquist filter assembly is installed on the demodulator card. The connectors on the filter assembly mate with J11 and J12 on the demodulator. Adjustments for the filter are factory set. Secure the filter to the demodulator card with four mounting screws.

2.6 INTERFACE CONNECTORS

The modem supports Transmit and Receive Clock and Data, plus SCT/ST Clock for RS422/449, and V.35 interfaces. An external RS422 level modulator carrier ON/OFF control is available for use as Request-To-Send (RTS/RS) on these interfaces. Also, an RS422 level carrier detect or decoder lock signal from the demod is available as Receiver Ready (RR) on the RS422/449 interface or carrier detect (CD) on the V.35 interface. These signals are user-optional and may be disabled using onboard jumpers. The modem does **NOT** support Clear-To-Send (CTS/CS) or Data-Set-Ready (DSR). The interface connectors and pin-outs are presented in the following tables:

Table 2-1	J1, J12 - Modem IF Connectors (BNC/Female)
Table 2-2	J2 - Station Clock Input Connector (BNC/ Female)
Table 2-3	J4, J5 - T1/CEPT/T2/E2 Connector (BNC/Female)
Table 2-4	J3 -T1/CEPT/T2/E2 Interface (15-Pin "D" Connector/Female)
Table 2-5	J3- V.35 (34-Pin Winchester Connector/ Female)
Table 2-6	J3 - RS-422 / 449 (37-Pin "D" Connector Female)
Table 2-7	J10 - Fault (ESC/FAULT Interface (25-Pin "D" Connector/Female)
Table 2-8	J6 - ESC Data Connector (ESC/FAULT Interface) 15-pin 'D' Connector
Table 2-9.	J7- Alarm I/O Connector (ESC/Fault Interface) 15-pin 'D' Connector (Male)

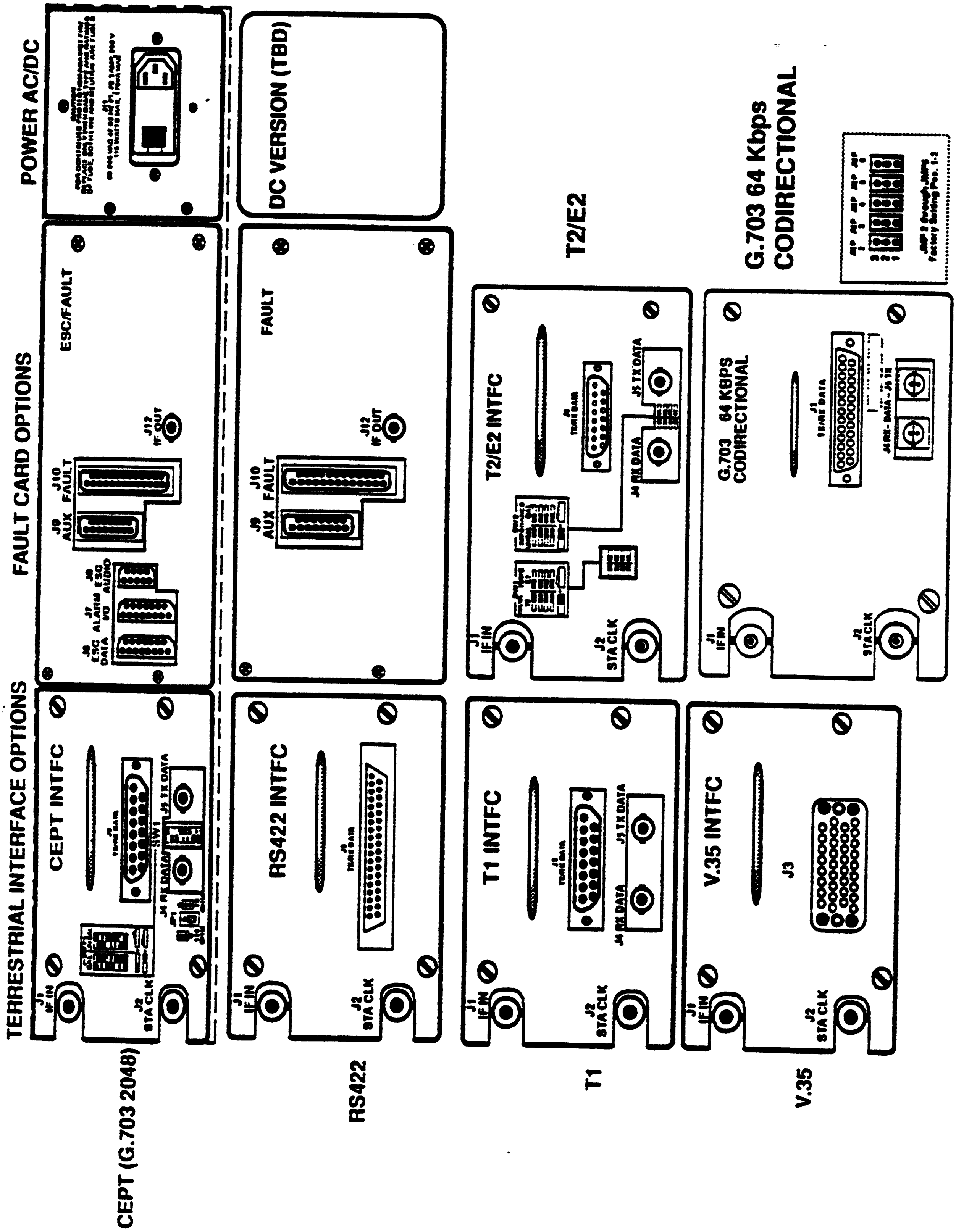


Figure 2-3. [1]SM2900 PLUS Rear Panel Connections

2.6.1 T2/E2 Interface Setup

The T2/E2 interface option is a dual interface that can be set up for either T2 or E2 data rates, balanced or unbalanced. The setup is established using dip switch settings on the interface. A silkscreen on the interface panel shows the SW1 settings for data rate and the SW2 settings for balanced/unbalanced. For T2 rate, the four SW1 switches should all be depressed on the right side. For E2 rate, the four SW1 switches should all be depressed to the left side. For unbalanced operation, the four SW2 switches should all be depressed on the right side. For balanced operation, the four SW2 switches should all be depressed on the left side. Line codes for the interface are programmable from the front panel or RS484 interface.

2.6.2 G.703 64 Kbps Setup

One user-selectable jumper is located beneath the rear panel cover in the lower left corner of the G.703 64 Kbps Interface. Place the jumper in the right-most position spanning pins 1 and 2 to allow octet timing violations, and to the left-most position spanning pins 2 and 3 to disable octet timing violations.

2.7 M&C/INTERFACE TEST POINTS (TP1-TP6)

There are six test points located on the edge of the M&C/Interface module. A brief description of what can be seen at each test point follows. The exact location of the test points is shown in Figure 2-4 and 2-5. All test points are buffered to prevent interference with modem operation.

2.7.1 Indicators (M&C/Interface Module)

There are two LED indicators present on the front edge of the M&C/Interface Module. The TEST indicator (CR2) illuminates yellow when the modem is placed in baseband loopback or is placed in the mode where a pure carrier is transmitted, or when clock calibration is performed. The M&C Interface FAULT summary indicator (CR1) illuminates red when any fault is detected on the M&C/Interface card. More detailed fault reporting can be accessed using the front panel keypad or the remote control port.

2.8 MODULATOR

2.8.1 Setup

The Modulator module is delivered with the external Carrier ON/OFF control (RTS) disabled. This RS-422 level signal is available through the RS-422/449, and V.35 interfaces. If use of this signal is required, such as in a demand SCPC application, jumper TP5 must be moved to the RTS ENABLE position. Otherwise, the jumper should remain in the RTS DISABLE position. Refer to Figure 2-6 for TP5 location.

M&C TP#	NAME	DESCRIPTION
TP1	GND	Ground
TP2	RXCLK	TTL version of the receive clock
TP3	RXDATA	TTL version of the receive data
TP4	TXCLK	TTL version of the transmit clock to modulator at the satellite rate
TP5	TXDATA	TTL version of the transmit data
TP6	SCTE	Transmit TTL clock from terrestrial Interface, internal clock or Rx clock depending upon clock option

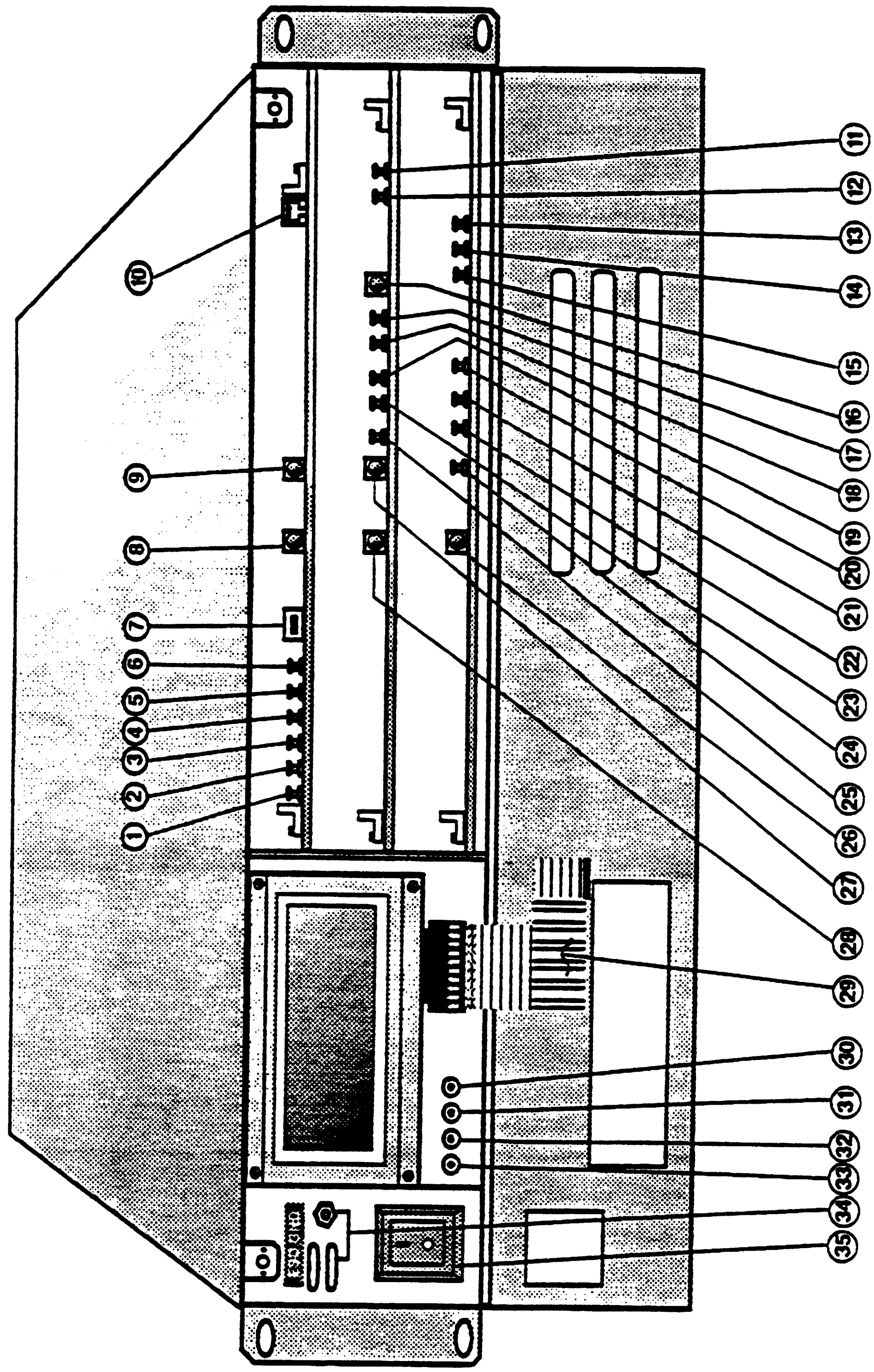
The modulator module is also delivered with the rotation control (spectral inversion control) jumper at TP22 installed for normal rotation for IBS, IDR, or ESC open network applications, or closed network applications with the SM2900 PLUS or other Fairchild modems. The jumper should remain in place for all of these applications. Removal of this jumper will invert the modulator output spectrum, and removal should only be required for closed network applications that require compatibility with other manufacturer's closed network modems, or with spectral inverting downconverters. Refer to Figure 2-6 for TP22 location.

All other modulator setup requirements are accomplished via front panel or remote control programming. Program the modulator output frequency data rate, and output power level to the desired values. Note that in addition to output power level, the ouput state can also be programmed for output on/off, pure carrier on/off, and transmit carrier default (TCD). TCD is the on/off state of the output at power-up or after power transient, and may be selected to be either OFF or LAST (LST). LST is the state of the output, on or off, when power was lost.

2.8.2 Monitor Points

There are six test points located on the edge of the Modulator card. A brief description of the signals present at each one follows. The location of the test points is shown in Figure 2-6. All of the test points are buffered to prevent interference with the modem during normal operation.

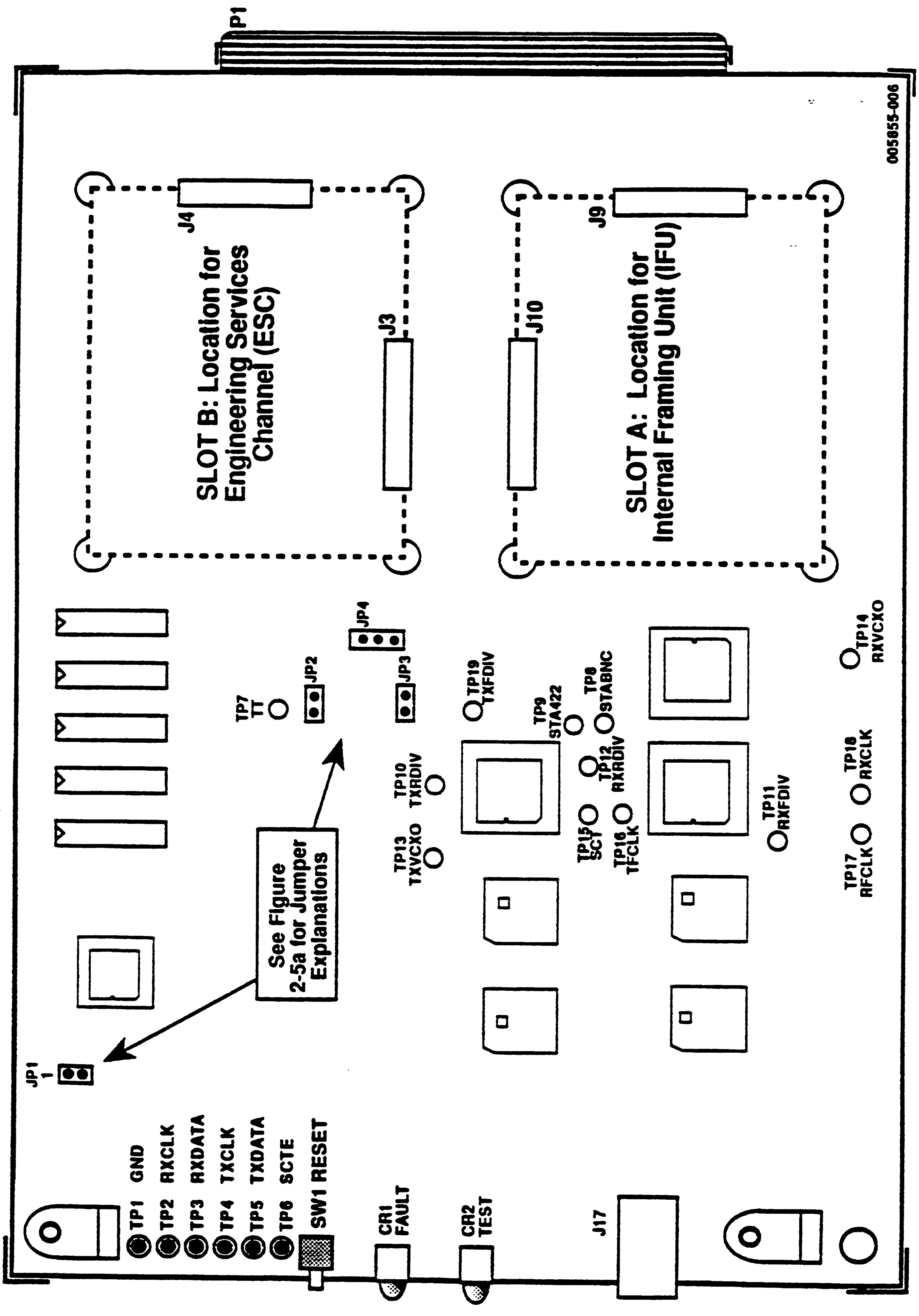
MOD TP#	NAME	DESCRIPTION
TP8	'P' Eye	'P' Channel Eye Pattern Display
TP6	'Q' Eye	'Q' Channel Eye Pattern Display
TP9	GND	Ground
TP7	GND	Ground
TP21 TP23	Symbol Clock	TTL Version of the Transmitted Symbol Clock
TP29	GND	Ground



LEGEND

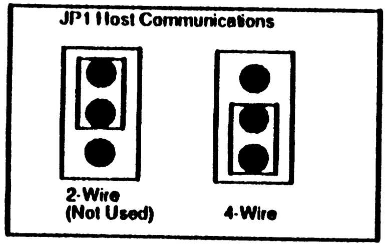
1. TP1 GND
2. TP2 Rx CLK
3. TP3 Rx DATA
4. TP4 TxCLK
5. TP5 TxDATA
6. TP6 SCTE
7. SW1 RESET
8. CR1 M&C Interface Card Fault LED (RED)
9. CR2 Test LED (Yellow)
10. J17 Remote Interface Input
11. TP14 Ground
12. TP13 AGC
13. TP23 Symbol Clock
14. TP29 Ground
15. TP21 Output Symbol Clock
16. CR8 Carrier Detect
17. TP18 Ground
18. TP17 'P' Channel Eye
19. TP25 Ground
20. TP7 Ground
21. TP6 'Q' Eye
22. TP9 Ground
23. TP19 'Q' Channel Eye
24. TP8 'P' Eye
25. TP15 Symbol Clock
26. CR2 Mod Fault
27. CR9 Dec Loc
28. CR7 Demod Fault
29. Ribbon Flex Cable
30. TP4 -15V
31. TP3 +15V
32. TP2 +5V
33. TP1 GND
34. ESD GND
35. Power ON/OFF Switch

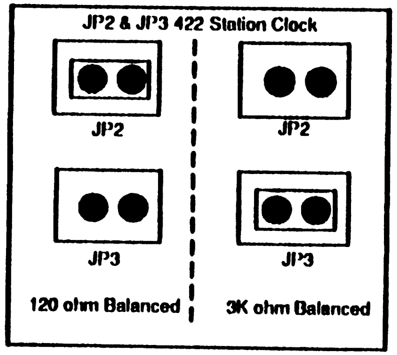
Figure 2-4. SM2900 PLUS Test Points, Controls and Indicators



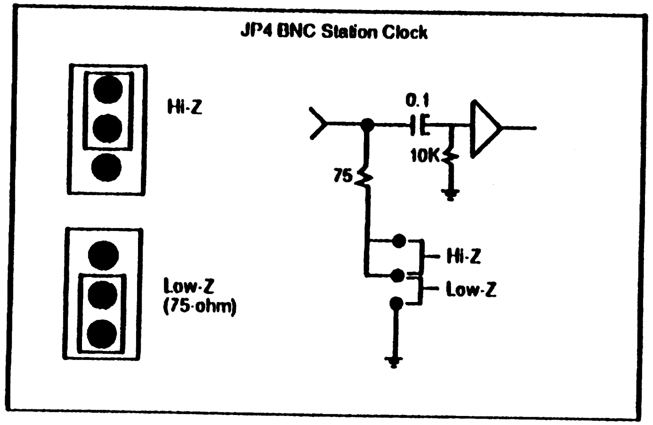
NOTE: This drawing is for reference only. Some components have been intentionally deleted.

Figure 2-5. M&C Board User-Selectable Items





M&C TPS FOR FACTORY USE		DESCRIPTION
TP8	STABNC	Station Clock BNC Test Point (TTL)
TP9	STA422	Station Clock 422 Test Point (TTL)
TP10	TxRDIV	Tx REF DIV to Phase DET
TP11	RxFDIV	Rx Feedback DIV to Phase DET
TP12	RxRDIV	Rx Ref DIV to Phase DET
TP13	TxVCXO	Tx VCXO (2^{25} MHz) 33.554432 MHz
TP14	RxVCXO	Rx VCXO (2^{25} MHz)
TP15	SCT	SCT Clock (TTL)
TP16	TFCLK	Tx Feedback Clock into DIV
TP17	RFCLK	Rx Feedback Clock into DIV
TP18	RxCLK	Rx Clock
TP19	TxFDIV	Tx Feedback DIV to Phase DET



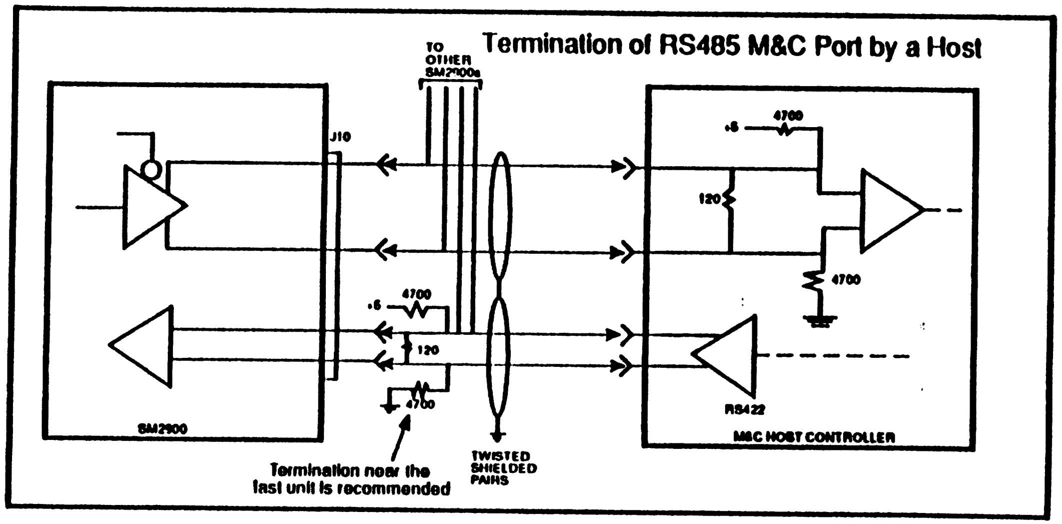


Figure 2-5a. Monitor & Control (M&C) Board Jumper Settings and Test Points for Factory-use Only

2.8.3 Indicators (Modulator)

There is one LED indicator present on the front edge of the Modulator. The Modulator FAULT summary indicator (CR2) illuminates red when any fault is detected on the modulator. More detailed fault information reporting can be accessed using the front panel keypad or the remote control port.

2.9 DEMODULATOR

2.9.1 Setup

The Demodulator module is delivered with the Receiver Ready (RR) signal disabled. This RS-422 level signal is available through the RS-422/449, and V.35 interfaces. It can be selected to be either demod Carrier Detect (CAR DET), Decoder Lock (LOCK), or LOCK M&C. LOCK M&C has a time holdoff for loss of decoder lock, while LOCK follows the decoder instantly. If the use of this signal is required, jumper TP2 must be moved to CAR DET, LOCK or LOCK M&C position. Placing the jumper in the RR INH position disables the tri-state RS-422 driver. Refer to Figure 2-7 for TP2 location.

All other demodulator setup requirements are accomplished via front panel or remote control programming. Program the demod data rate and synthesizer frequency to the desired values. The demod acquisition sweep covers ± 25 KHz acquisition range.

2.9.2 Monitor Points

There are six test points located on the edge of the Demodulator card. A brief description of each follows. The location of the test points is shown in Figure 2-4 and 2-7. All test points are buffered so that their use does not interfere with normal modem operation.

The demodulator module is also delivered with the spectral inversion jumper at TP11 in the NORM position for IBS, IDR, or ESC open network applications, and closed network applications with the SM2900 PLUS or other Fairchild modems. The jumper should remain in the NORM position for all of these applications. (Note that no jumper installed in either the NORM or INV positions will also result in normal demodulator spectrum). Placing the jumper in the INV position will result in inversion of the demodulator spectrum, and this should only be required for closed network applications that require compatibility with other manufacturer's closed network modems, or with spectrum inverting downconverters. Refer to Figure 2-7 for TP11 location.

All other demodulator setup requirements are accomplished via front panel or remote control programming. Program the demod data rate and synthesizer frequency to the desired values. The demod acquisition sweep covers ± 25 KHz acquisition range.

2.9.3 Indicators (Demodulator)

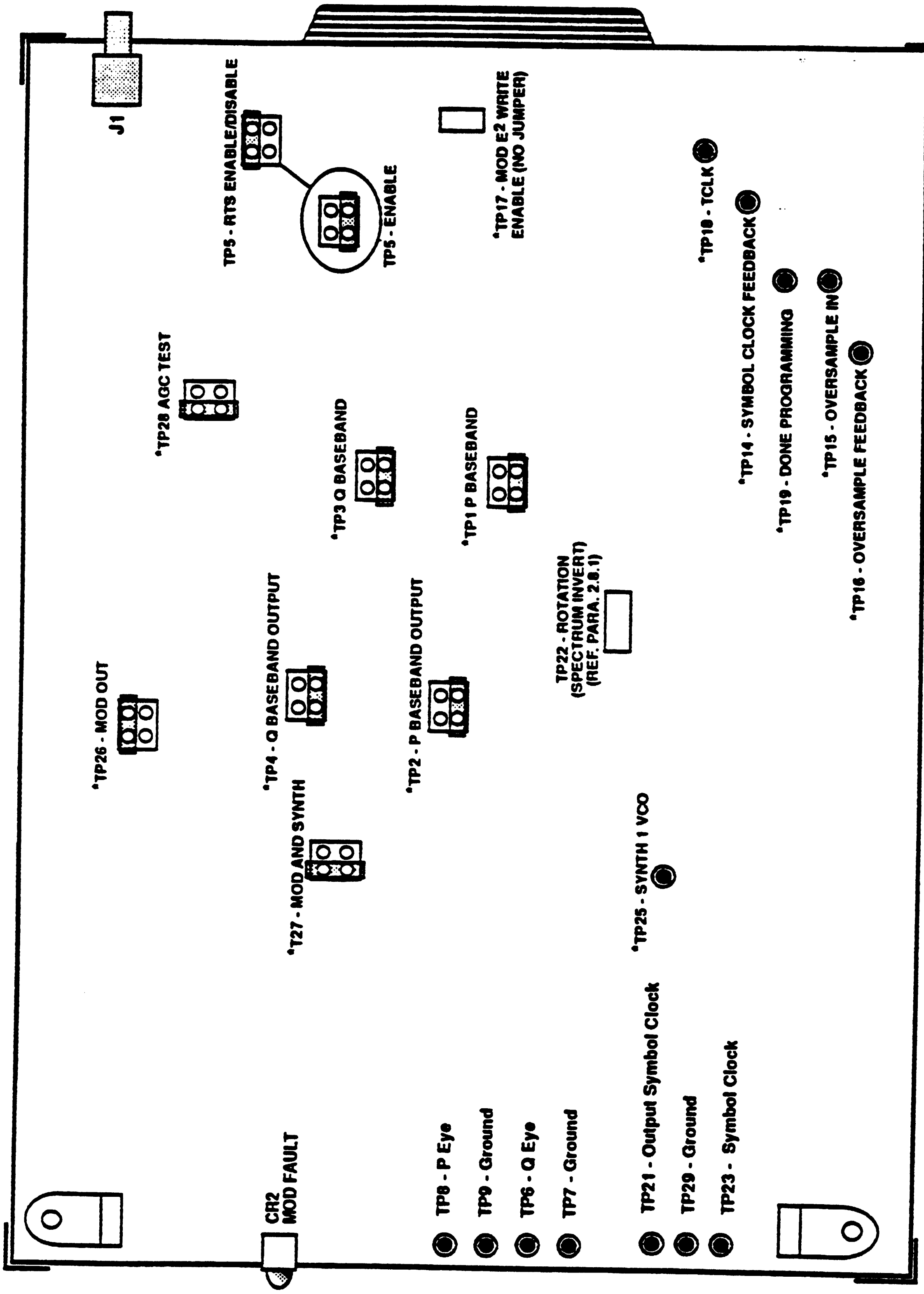
There are three LED indicators on the front edge of the Demodulator. The CARRIER DETECT indicator (CR8) illuminates green when there is an RF signal present near the programmed demodulator receive frequency.

NOTE

This indicator (CR8) does not guarantee that the signal is modulated at the proper data rate, within the demod AGC range, etc. It only indicates the presence of IF energy *near* the expected frequency.

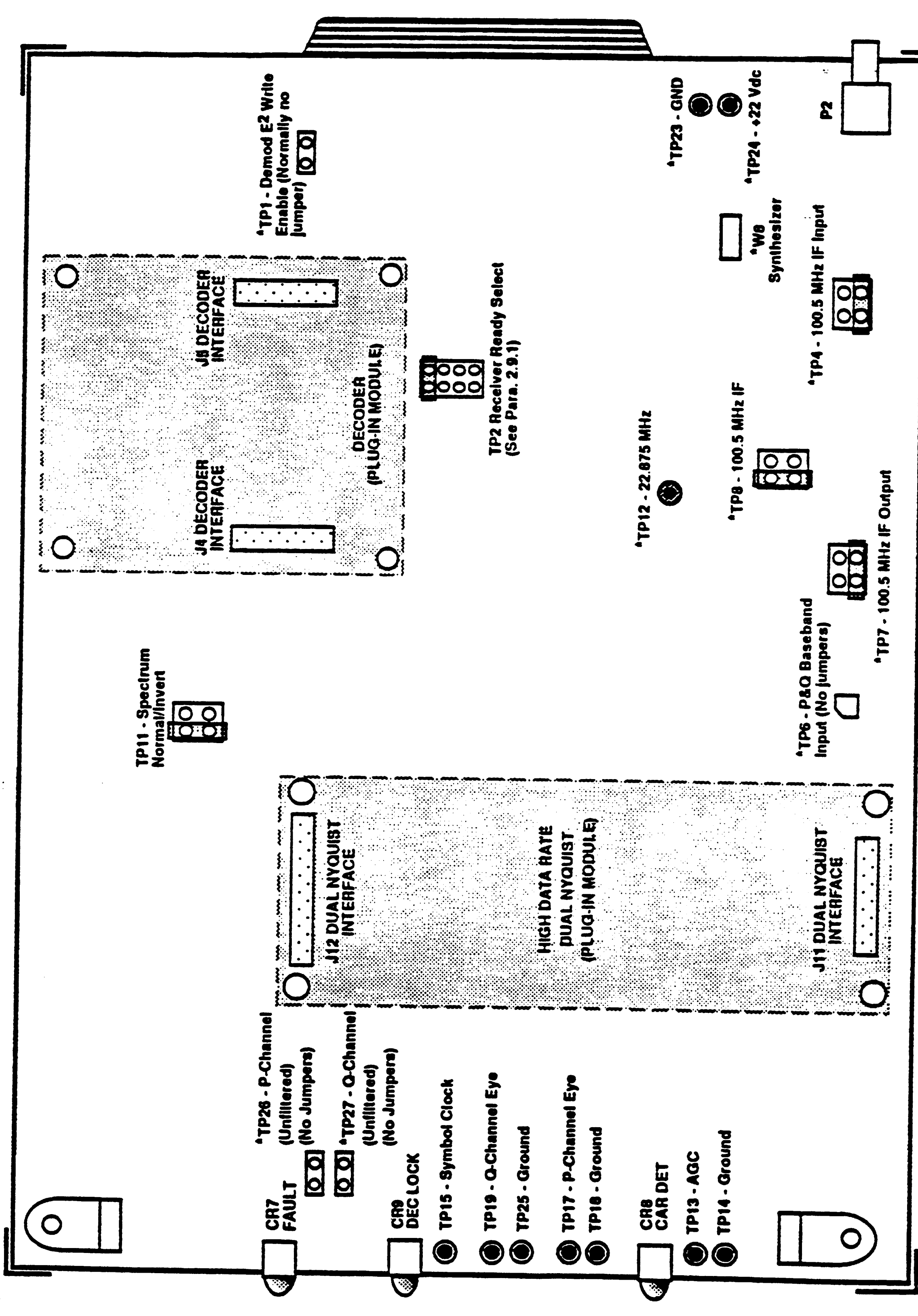
The DECODER LOCK indicator (CR9) illuminates green when the decoder has locked on to the demodulated signal, indicating acquisition. The Demodulator FAULT summary indicator (CR7) illuminates red when any fault is detected on the demodulator or decoder. More detailed fault information reporting can be obtained by using the front panel keypad or the remote control port.

DEMOD. TP #	NAME	DESCRIPTION
TP15	CLK	TTL Version of the recovered symbol clock (Used as sync for P and Q)
TP17	'P'	'P' Channel receive eye pattern display
TP19	'Q'	'Q' Channel receive eye pattern display
TP13	AGC	AGC Test Point. Voltage proportional to AGC level
TP14 18 25	GND	Ground



Note: Some items have been intentionally deleted. The user-selectable items shown have been enlarged for clarity and are located in the approximate areas as illustrated. Items marked with an asterisk are factory-set and are for reference only– no adjustments by the user are necessary.

Figure 2-6. SM2900 PLUS Modulator User-selectable Items.



Note: Some items have been intentionally deleted. The user-selectable items shown have been enlarged for clarity and are located in the approximate areas as illustrated. Items marked with an asterisk are factory-set and are for reference only– no adjustments by the user are necessary.

Figure 2-7. SM2900 PLUS Demodulator User-selectable Items

Table 2-1. J1, J12 - Modem IF Connectors (BNC / Female)

Connector	Function
J1 J12	IF IN (75 Ω) IF OUT (75 Ω)

Table 2-2. J2 - Station Clock Input Connector (BNC / Female)

Connector	Function	Signal Direction
J2	STATION CLOCK	IN

Table 2-3. T1 / CEPT/T2/E2 Connectors (BNC / Female)

Connector	Function	Signal Direction
J4	RX DATA DS1 / CEPT/T2/E2	OUT
J5	TX DATA DS1 / CEPT/T2/E2	IN

NOTE 1 : Legend on the rear of the CEPT Interface indicates settings BAL/UNBAL and 75/120 ohms. Unbalanced grounds the outside shell of the BNC connector and J3-9 (Tx) and J3-11 (Rx).

NOTE 2: Legend on the rear of the T2/E2 Interface indicates impedance settings for BAL/UNBAL. Unbalanced grounds the outside shell of the BNC connector, and J3-9 (Tx), and J3-11 (Rx). Balanced impedance is 75 ohms and unbalanced impedance is 110 ohms.

Table 2-4. J3 - T1 / CEPT/T2/E2
15-Pin "D" Connector (Female)

Pin	Signal Direction	Signal	Description
1	Input	SD-A	Send Data - A
2		GND	Signal Ground
3	Output	RD-A	Receive Data
4		GND	Signal Ground
5			Not Used
6			Not Used
7			Not Used
8			Not Used
9	Input	SD-B	Send Data - B
10			Not Used
11	Output	RD-B	Receive Data - B
12			Not Used
13			Not Used
14	Output*	Tx FLT TTL	Transmit Fault - TTL Level Signal
15	Output*	Rx FLT TTL	Receive Fault - TTL Level Signal

*Open Collector (Lo = Ok, Hi = Fault)

Table 2-5. J3 - V.35 Interface
34-Pin Winchester Connector (Female)

Pin	Signal Direction	Signal	Description
A		GND	Signal Ground
B		GND	Signal Ground
C	Input	RTS-A	Optional Request To Send (Carrier ON/OFF-A (RS-422 Carrier ON/OFF)
D			Not Used
E			Not Used
F	Output	Carrier Detect-A	Carrier Detect-A (RS-422 Carrier Detect or Decoder Lock)
G			Not Used
H			Not Used
J	Output	Carrier Detect-B	Carrier Detect-B (RS-422 Carrier Detect or Decoder lock)
K	Input	RTS-B	Optional Request To Send-B (RS-422 Carrier ON/OFF)
L			Not Used
M			Not Used
N			Not Used
P	Input	SD - (A)	Send Data-A
Q			Not Used
R	Output	RD - (A)	Receive Data-A
S	Input	SD + (B)	Send Data-B
T	Output	RD + (B)	Receive Data-B
U	Input	SCTE - (A)	Serial Clock Transmit EXT-A
V	Output	RT - (A)	Receive Timing-A
W	Input	SCTE + (B)	Serial Clock Transmit EXT-B
X	Output	RT + (B)	Receive Timing-B
Y	Output	SCT - (A)	Serial Clock Transmit-A
Z			Not Used
aa	Output	SCT + (B)	Serial Clock Transmit-B
bb			Not Used
cc			Not Used
dd			Not Used
ee			Not Used
ff			Not Used
gg			Not Used
hh			Not Used
mm	Output*	Tx FLT TTL	Transmit Fault - TTL level Signal
nn	Output*	Rx FLT TTL	Receive Fault - TTL Level Signal

*Open Collector (Lo = Ok, Hi = Fault)

Table 2-6. J3 - RS-422 /449 Interface
37-Pin "D" Connector (Female)

Pin	Signal Direction	Signal	Description
1		GND	Signal Ground
2			Not Used
3	Output*	Tx Fault TTL	Transmit Fault - TTL level Signal
4	Input	SD - (A)	Send Data A
5	Output	ST - (A)	Send Timing A
6	Output	RD - (A)	Receive Data A
7	Input	RTS-(A)	Optional-Request-To Send (Carrier ON/OFF)
8	Output	RT - (A)	Receive Timing A
9			Not Used
10			Not Used
11			Not Used
12			Not Used
13	Output	RR-(A)	Optional-Receiver Ready (Carrier Detect or Decoder Lock)
14			Not Used
15			Not Used
16			Not Used
17	Input	TT - (A)	Terminal Timing A
18			Not Used
19		GND	Signal Ground
20		GND	Signal Ground
21	Output*	Rx FLT TTL	Receive Fault - TTL Level Signal
22	Input	SD + (B)	Send Data B
23	Output	ST + (B)	Send Timing B
24	Output	RD + (B)	Receive Data B
25	Input	RTS-(B)	Optional-Request To Send (Carrier ON/OFF)
26	Output	RT + (B)	Receive Timing B
27			Not Used
28			Not Used
29			Not Used
30			Not Used
31	Output	RR-(B)	Optional-Receiver Ready (Carrier Detect or Decoder Lock)
32			Not Used
33			Not Used
34			Not Used
35	Input	TT + (B)	Terminal Timing B
36			Not Used
37		GND	Signal Ground

*Open Collector (Lo=Ok, Hi=Fault)

Table 2-7. J10 - Fault (ESC/FAULT Interface)
25-Pin "D" Connector (Female)

Pin	Signal Direction	Signal	Description
1		Tx FLT FORM C NO	Transmit Fault Form C, Normally Open Relay
2		Tx FLT FORM C COM	Transmit Fault Form C, Common Relay
3		Tx FLT FORM C NC	Transmit Fault Form C, Normally Closed Relay
4	Output*	Tx FLT TTL	Transmit Fault - TTL Level Signal
5	Output	BUFF CLK OUT -	Buffered Clock Out
6		GND	Signal Ground
7	Input	BUFF CLK IN +	Buffered Clock In
8		GND	Signal Ground
9	Input	485 + Rx	485 Receive (Positive)
10	Output	485 + Tx	485 Transmit Positive)
11	Output	MCOC01	
12	Output	MCOC02	
13			Not Used
14		Rx FLT FORM C NO	Receive Fault Form C, Normally Open
15		Rx FLT FORM C COM	Receive Fault Form C, Common
16		Rx FLT FORM C NC	Receive Fault Form C, Normally Closed
17	Output*	Rx FLT TTL	Receive Fault - TTL Level Signal
18	Output	BUFF CLK OUT +	Buffered Clock Out
19		GND	Signal Ground
20	Input	BUFF CLK IN -	Buffered Clock In
21	Input	485 - Rx	485 Receive (Negative)
22		GND	Signal Ground
23	Output	485 - Tx	485 Transmit (Negative)
24	Input	STACLK - A (RS-422)	Station Clock-A (RS-422)
25	Input	STACLK - B (RS-422)	Station Clock-B (RS-422)

*Open Collector (Lo = Ok, Hi = Fault)

Table 2-8. J6 ESC Data Connector (ECS/FAULT Interface) 15-pin 'D' Connector (Male)

Pin	Signal Direction	Signal	Description
1	Output	TXOCT - A	Transmit Octet - A
2	Input	TXDATA - A	Transmit Data - A
3	Output	OPENCOL1	Reserved
4	Output	TXCLK - A	Transmit Data - A
5		GND	Signal Ground
6	Output	RXCLK - A	Transmit Clock - A
7	Output	RXDATA - A	Receive Data - A
8	Output	RXOCT - B	Receive Octet - A
9	Output	TXOCT - B	Transmit Octet B
10	Input	TXDATA -B	Transmit Data - B
11			
12	Output	TXCLK - B	Transmit Clock - B
13	Output	RXCLK - B	Receive Clock - B
14	Output	RXDATA - B	Receive Data - B
15	Output	RXOCT - B	Receive Octet - B

Note: Tx and Rx Data, Clock and Octet are all RS422 level signals.

Table 2-9. J7 Alarm I/O Connector (ESC/FAULT Interface) 15-pin 'D' Connector (Male)

Pin	Signal Direction	Signal	Description
1	Input	ALRM1 - IN	Backward Alarm 1 In
2	Input	ALRM2 - IN	Backward Alarm 2 In
3	Input	ALRM3 - IN	Backward Alarm 3 In
4	Input	ALRM4 - IN	Backward Alarm 4 In
5	Output	ALRM1 - NO	Backward Alarm 1 Out No (IBS), Note 3
6	Output	ALRM2 - NO	Backward Alarm 2 Out No
7	Output	ALRM3 - NO	Backward Alarm 3 Out No
8	Output	ALRM4 - NO	Backward Alarm 4 Out No
9	Output	OPENCOL2	Receive Prompt Alarm
10		GND	Signal Ground
11		ALRMCOM	Backward Alarm Common
12	Output	ALRM1 - NC	Backward Alarm 1 Out NC
13	Output	ALRM2 - NC	Backward Alarm 2 Out NC
14	Output	ALRM3 - NC	Backward Alarm 3 Out NC
15	Output	ALRM4 - NC	Backward Alarm 4 Out NC (IBS), Note 3

Note 1) The Common for ALRM1-NO thru ALRM4 - NO are all tied together and normally grounded. Alarm status with common = GND: OK is comm tied to NO contact, fail is comm tied to NC Contact.

Note 2) Backward Alarm inputs are TTL with LO = ground is OK status and HI = open is fail status. Max input is ± 48 Volts.

Note 3) Contacts for IBS operation

Table 2-10. J8 ESC AUDIO Connector (ESC/FAULT Interface) 9-pin 'D' Connector (Male)			
Pin	Signal Direction	Signal	Description
1	Input	AUDIN1A	Audio 1 - A In
2	Output	AUDOUT1A	Audio 1 - A Out
3		GND	Signal Ground
4	Input	AUDIN2A	Audio 2-A In
5	Output	AUDIN2A	Audio 2-A Out
6	Input	AUDIN1B	Audio 1-B In
7	Output	AUDOUT1B	Audio 1-B Out
8	Input	AUDIN2B	Audio 2-B In
9	Output	AUDOUT2B	Audio 2-B Out

Note: Audio impedance is balanced 600 ohm input and output

Table 2-11. J9 AUX Interface (ESC/FAULT Interface) 15-pin 'D' Connector.(Female)			
Pin	Signal Direction	Signal	Description
1	Output	485-SPAR	Reserved
2		BOCLK2+	Buffer Clock B(2) Output +
3			
4	Input	RTS-(A)	Request to send - (A), Tx IF On/Off
5			
6	Output	RR-(A)	Receiver Ready - (A)
7	Input	BICLK2+	Buffer Clock B (2) In (Return)+
8		GND	Signal Ground
9	Output	+5V	+5 Volts
10	Output	BOCLK2-	Buffer Clock B(2) Output -
11			
12			
13	Input	RTS+ (B)	Request to send - (B), Tx IF On/Off
14	Output	RR+ (B)	Receiver Ready + (B)
15	Input	BICLK 2-	Buffer Clock B (2) In (Return)-

Notes: BOCLK2, RTS and RR Levels are RS422

Table 2-12. J17 M&C Connector
RS232 COM Port (Behind Front Panel)
6-Pin Female (Dupont 68898-002)

Pin	Signal Direction	Signal	Description
1		GND	Signal Ground
2	Out	Tx Out	Transmit Out (RS232)
3			
4	Out	+5V	+5 Volts for external use
5	In	Rx In	Receive In (RS232)
6			

Table 2-13. G.703 64 Kbps Connectors (Twinax/Female)

Connector	Function	Signal Direction
J4	Rx Data	OUT
J5	Tx Data	IN

Table 2-14. G.703 64 Kbps 25-Pin 'D' Connector (Female)

Pin	Signal Direction	Signal	Description
1	Input	Tx GND	Signal Ground
16	Input	Tx Data (+)B	Transmit Data (+)B
14	Output	Rx Data (+)B	Receive Data (+)B
3	Input	Tx Data (-)A	Transmit Data (-)A
15	Input	Rx GND	Signal Ground
2	Output	Rx Data (-)A	Receive Data (-)A
19	Output	Tx FLT	Transmit Fault
20	Output	Rx FLT	Receive Faul

2.10 ESC Audio Level

The ESC audio interface has two balanced 600 ohm voice circuits which are each digitized into 32 Kbps ADPCM data streams and muxed into the satellite overhead. These audio levels are set at the factory for nominal signal levels of -5 dBm input and -5 dBm output (Net gain = 0 dB). Under these conditions the audio circuits nominally achieve a 30 to 35 dB S/N ratio for either psophometric or C-message weighting for input levels from -5 to -15 dBm. Normally, adjustments are made external to the modem to trim the audio levels to these values. In rare instances this is not possible and it may be necessary to adjust the nominaLoperating level of the ESC card. To change the levels use the following procedure:

1. A Fairchild authorized distributor should make the modifications whenever possible.

2. Mail or FAX Fairchild Data (Attention Quality Assurance Department) about the change in resistor values including the following information:

   Name of Purchaser ________________
   Sales Order Number ________________
   Part number of ESC card ________________
   Revision level of ESC card ________________
   Serial Number of ESC card ________________
   Tx (input level) = (CH2) ________________ dBm (CH1)________________ dBm
   Rx (input level) = (CH2) ________________ dBm (CH1)________________ dBm
   Resistor values installed (See table)

RH2		RH1	
R1a =	________ K Ohm	R1a =	________ K Ohm
R1b =	________	R1b =	________
R2a =	________	R2a =	________
R2b =	________	R2b =	________
R4a =	________	R4a =	________
R4b =	________	R4b =	________
R3a =	________	R3a =	________
R3b =	________	R3b =	________

3. If the Tx and Rx levels for the audio circuits are different than -5 dBm locate the operating level in the table below. RHy-# corresponds to either RH1-# or RH2-# for audio channel 1 or channel 2 respectively. Adjacent to the levels are the resistor values for the Tx and Rx circuits to put into the ESC card. There is approximately 3 dB of head room above these levels before compression occurs.

Tx					Rx			
RHy-1 (K Ohm)	RHy-2 (K Ohm)	RHy-3 (K Ohm)	RHy-4 (K Ohm)	LEVEL (dBm)	RHy-7 (K Ohm)	RHy-8 (K Ohm)	RHy-5 (K Ohm)	RHy-6 (K Ohm)
22.0	100.0	2.2	22.0	+5	0	0	Open	Open
18.0	1000.0	3.3	6.8	+4	2.2	180.0	33.0	39.0
18.0	560.0	2.7	39.0	+3	4.7	33.0	27.0	39.0
27.0	47.0	3.9	10.0	+2	6.8	39.0	15.0	270.0
18.0	270.0	3.3	82.0	+1	8.2	68.0	15.0	82.0
18.0	180.0	3.9	39.0	0	10.0	68.0	12.0	180.0
27.0	39.0	4.7	27.0	-1	10.0	1000.0	10.0	1000.0
18.0	120.0	4.7	100.0	-2	12.0	150.0	15.0	22.0
22.0	47.0	5.6	47.0	-3	22.0	27.0	10.0	39.0
15.0	330.0	6.8	33.0	-4	18.0	47.0	8.2	56.0
15.0	150.0	8.2	27.0	-5	15.0	150.0	8.2	27.0
18.0	47.0	8.2	56.0	-6	15.0	330.0	6.8	33.0
22.0	27.0	10.0	39.0	-7	22.0	47.0	5.6	47.0
12.0	150.0	15.0	22.0	-8	18.0	120.0	4.7	100.0

Tx					Rx			
RHy-1 (K Ohm)	RHy-2 (K Ohm)	RHy-3 (K Ohm)	RHy-4 (K Ohm)	LEVEL (dBm)	RHy-7 (K Ohm)	RHy-8 (K Ohm)	RHy-5 (K Ohm)	RHy-6 (K Ohm)
10.0	1000.0	10.0	1000.0	-9	27.0	39.0	4.7	27.0
10.0	68.0	12.0	180.0	-10	18.0	180.0	3.9	39.0
3.2	68.0	15.0	82.0	-11	18.0	270.0	3.3	82.0
5.8	39.0	15.0	270.0	-12	27.0	47.0	3.9	10.0
4.7	33.0	27.0	39.0	-13	18.0	560.0	2.7	39.0
2.2	180.0	33.0	39.0	-14	18.0	1000.0	3.3	6.8
0	0	Open	Open	-15	22.0	100.0	2.2	22.0

4. The exact location of the resistors is visible from the silk-screen on the ESC card and the approximate orientation is as follows for each channel, the card is layed out for 1/8-Watt resistors in these locations:

RH2	RH1
RH2-1	RH1-1
RH2-2	RH1-2
RH2-3	RH1-3
RH2-4	RH1-4
RH2-5	RH1-5
RH2-6	RH1-6
RH2-7	RH1-7
RH2-8	RH1-8

SECTION 3 - OPERATION

3.1 INTRODUCTION

The following paragraphs provide the procedures and information necessary to properly set up and operate the SM2900 PLUS Satellite Modem. Setup information will be discussed by subassembly which will be followed by operating procedures for the keypad and M&C control and interface. The information and figures in this section, in conjunction with Section 4 (Maintenance), and Section 2 (Installation), should be used to familiarize the user with the equipment. This will result in more effective operation.

3.2 MODULE OPERATION AND CHECKOUT

Refer to Section 2, Figure 2-1, and Figure 2-4 for module locations, test points, controls and indicators.

3.3 POWER SUPPLY

The power supply is installed at the factory as part of the chassis assembly. It is located behind the power supply test points and LCD display as shown in Figure 3-1. An autoranging AC power supply that does not require any switch settings or wiring changes to accommodate line voltage variation from 90 to 250 Vac provides power to the SM2900 PLUS. The absence of a line voltage selector switch on the power supply line filter assembly on the rear of the chassis verifies that an autoranging power supply is installed in the chassis.

Adjustment of the DC voltages is NOT required for operation of the unit. Test points are available behind the fold-down front panel and below the LCD display for measuring the +5, +15, and -15 Vdc supply voltages. The values shown below should be measured with a high impedance voltmeter to verify that they are within the indicated ranges. The measured values are slightly higher than the voltage actually present on the circuit cards due to the line loss. The voltage ranges listed below are with the M&C Interface, Demodulator, and Modulator cards installed.

ITEM	VOLTAGE RANGE	DESCRIPTION
TP1	---	GND
TP2	+5.3 to +5.4 Vdc	+5V
TP3	+14.25 to +15.75 Vdc	+15V
TP4	-14.25 to -15.75 Vdc	-15V

An ON/OFF switch is located on the front of the chassis to the left of the LCD display, and is accessible through an opening in the front panel. It is a rocker switch with the international I/0 markings for ON/OFF indication.

3.4 RESET OPERATION (SW1)

Manually depressing SW1 on the front edge of the M&C/Interface module reinitializes the modem through the M&C as though prime power was removed and reapplied. This is not used during normal operation.

3.4.1 Station Clock Impedance Selection (J2)

Refer to Section 2.

3.5 SM2900 PLUS OPERATING PROCEDURES

The modem can be operated locally using the front panel keypad and 80-character LCD or remotely using the serial remote control interface (J10) on the rear of the unit. There is also a special RS232 local control port (J17) behind the front panel for plugging in a separate hand-held keypad display terminal which operates identically with the front panel keypad/display.

It is important to note that the modem has three methods of control, none with priority over the other, and responds to commands from the keypad or J10 or J17 on a 'first-come, first-served' basis. In other words, the modem is not put into a 'remote' or 'local' mode, but is always in both.

3.5.1 Local Control

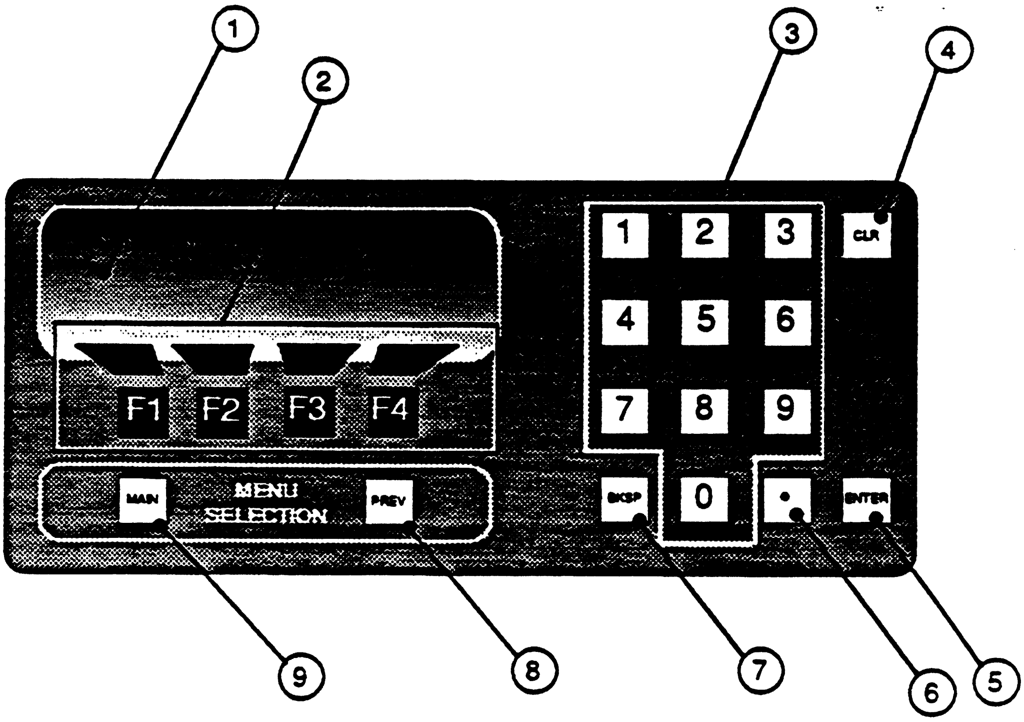
Local control of user-defined parameters is accomplished using the keypad and LCD on the front panel. Figure 3-1 illustrates the front panel keypad and display and describes the function of each of the keys.

An example of how to change the receive data rate is shown in Figure 3-2. Table 3-1 shows an alphabetized list of mnemonics and other terms used in the modem control menu and their definitions.

Local control is menu-driven and utilizes 'soft' function keys (F1 through F4) to select menu choices until the desired parameter is attained. Using the labels above the function key, small sentences are formed to reach the objectives of the menu. For example, in Figure 3-2, the sentence reads: PROG- Rx- DATA- RATE- and the menu appears showing the existing receive data rate and prompting for a NEW? receive data rate.

In the control mode, the user is prompted by a question ('CHANGE TO?' or 'NEW?') and can change the parameter by entering the desired choice as defined by F1 through F4, or a number using the numeric keypad. In either case, the command is not executed until the ENTER button is depressed. The display will now confirm that the new choice has been made and prompt the user for selection.

To go to another position on the menu to change other parameters, the MAIN or PREV button can be depressed, although the PREV button is recommended to avoid repeated trips through the same menu.

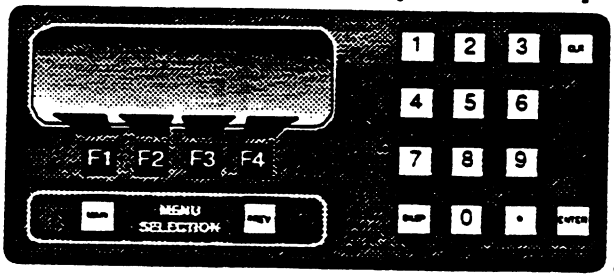


LEGEND

1. **DISPLAY** - 4 line by 20 character LCD for monitoring local command, status, configuration
2. **FUNCTION KEYS** - Permits selection of items from display that are located above the function keys
3. **NUMBERS** - Entry of numberic parameters (data rate, frequency, power)
4. **CLEAR** - Clears the entry and allows keypad entry to start over
5. **ENTER** - Executes or implements the command upon completion of command entry. Enter must be pushed to accept or execute parameter.
6. **DECIMAL POINT** - For numeric entry
7. **BACKSPACE** - Clears last keystroke entry and allows re-entry
8. **PREVIOUS** - Exits existing operating mode and returns to the previous step in the menu selection process
9. **MAIN** - Existing operation at power-up

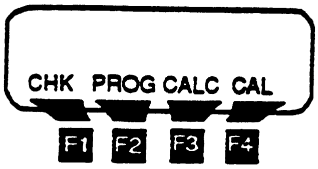
Figure 3-1. Front Panel Keypad

Programming Rx Data Rate from 56 Kbps to 2048 Kbps in 5 steps



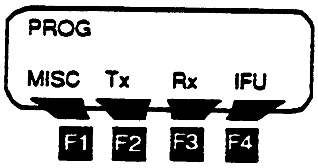
LCD and Keypad

1.



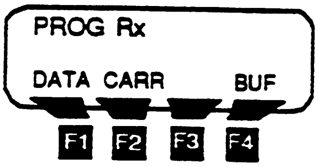
Main Menu as shown in display at power up
Press F2 to select Programming Parameters (PROG)

2.



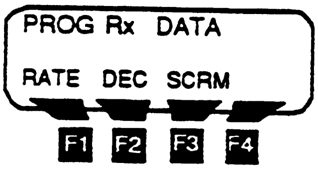
Press F3 to select PROG Rx

3.



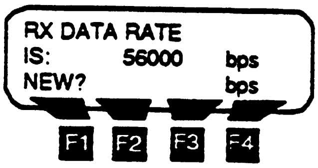
Press F1 to select PROG Rx DATA

4.



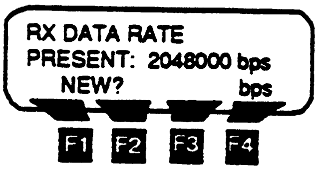
Press F1 to select PROG Rx DATA RATE

5.

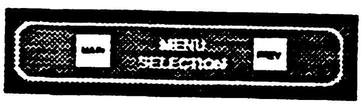


Enter new Rx Data Rate in display using keypad

Press the ENTER key to change Data Rate



New Rx Data Rate is shown in display



Return to Main or Previous Menu.

Figure 3-2. Programming Data Rates

Table 3-1. Keypad and Display Abbreviations/Functions

Abbreviation	Definition	Refers To: (Description/Function)
290 STA	SM290 Station Clk	SM290 Compatible Station Clk mode
ADDR	Address	RS485 Unit or "Phantom" Address
AIS	Alarm Indication Signal	All 1's asserted
AMI	Alternate Mark Inversion	Refers to a terrestrial interface which transmits only the marks of the data pattern with an embedded clock. Where each mark is opposite polarity of the previous with respect to ground
B8ZS	Binary 8 Zero Substitution	Refers to a linecode type supported on the T1 AMI interface
BACK ALM	Backward Alarm	Alarm in the Satellite Tx stream which indicates Rx troubles on this side to the opposite end
BAUD	BAUD Rate	Sets Rate of the RS485 Host interface
BER	Bit Error Rate	Number of errors in a quantity of bits
BNC	BNC	Station clock input at J2 on rear panel
BUF	Buffer	Transmit or Receive buffer
BUFA	Buffer Clk A	Refers to Buffer Clk outputs and inputs on the 25-pin Fault connector on the rear of the modem
BUFB	Buffer Clk B	Refers to Buffer Clk outputs and inputs on the 15-pin Auxillary connector on the rear of the modem
BYPS	Bypass Mode	State of framer or deframer where no framing or deframing overhead is added or subtracted to or from the satellite stream
CAL	Calibration	Used for calibration of clock oscillators
CALC	Calculator	Calculator mode (RPN entry)
CARR	Carrier	Modulator or Demodulator carrier
CARR DET	Carrier Detect	Carrier detection in the demod
CFG	Configuration	Monitoring of module configuration
CHK	Check	Used to check modem status
CLKS	Clocks	Reference, data, and buffer clocks
CONTR	Contrast	Display contrast adjustment
DATA RATE	Data Rate	
DEC	Decoder	FEC decoder, or differential decoder
DEM	Demodulator	Demodulator/Rx functions
DFRAM	Deframing	Refers to receive deframing
DIFF	Differential	Used with DEC and ENC when referring to differential decoder and differential encoder
DTE	Data Terminal Equipment	Selection of clock reference for the DTE
ENC	Encoder	FEC encoder, or differential encoder
ERR	Error	Not correct
EVEN	Even	A type of Parity
EXT	External	Transmit clock from DTE
FDC	Fairchild Data Corp	An implementation of V.35 scrambling
FEC	Forward Error Correction	Encoder and decoder (FEC type)
FLTS	Faults	Monitoring of faults
FRAM	Framing	Refers to transmit framing
G732	G.732	A type of Terrestrial framing to which 0% overhead is added during satellite transmission
HDB3	HDB3	A type of linecode supported when using a CEPT interface
IBS	IBS	A type of framing where overhead is added

Abbreviation	Definition	Refers To: (Description/Function)
		at a fixed relationship of 16/15 times the Data rate
IDR	IDR	A type of framing where a fixed 96 kbps of overhead is added to the terrestrial data stream before transmission
IFU	Internal Framing Unit	The daughter card fitted to the Monitor and Control board in slot A (See Figure 2- 5) which gives the SM2900 the ability to add overhead to a Terrestrial stream
INV	Invert	Used in reference to the Tx Clock, to specify inversion of the active clock edge for the terrestrial data
INT	Internal	Internal transmit clock (SCT)
INTFC	Interface	Baseband or terrestrial interface
LINE CODE	Terrestrial linecode	On AMI type of interfaces refers to type of linecode such as HDB3, or B8ZS. A linecode of AMI means no line coding of the AMI signal
LINE LEN	Line length	On T1 interface only. Allows an equalizer to compensate for cable length
LINK	Linkabit	Data scrambler compatible with Linkabit LM46 Satellite Modem
LOS	Loss of Signal	Loss of Tx clock on RS422 and V.35 interface or loss of Tx signal on T1, E1, T2, or E2 interface
LPBK	Loopback	Baseband loopback
LST	Last	Sets TCD condition to transmitter power and frequency last used (as opposed to OFF)
LVL	Level	Magnitude of transmit IF output power
M&C	Monitor & Control	Monitor and Control/Interface module
MISC	Miscellaneous	Refers to parameters not directly related to mod, demod, or IFU
MOD	Modulator	QPSK modulator module
N/455	Ratio:	Data Rate/455 Option which forces the Rx Data buffer to compensate for one typical doppler path
NARR	Narrow	Demod acquisition range (as opposed to wide)
OK	Okay	Not faulted
ODD	Odd parity	A type of parity
OPT	Option	Transmit or Receive clock option, or buffer slip option
PAR	Parity	Refers to RS485 address
PROG	Program	Used to command operation
PURE CARR	Pure Carrier	Unmodulated, or 'clean' carrier; output by the modulator
PWR	Power	Modulator output power setting and monitoring
RCNTR	Recenter	Used with Tx and Rx buffers to force them to their centers
REF	Reference	Clock baseline source
RTI	Remote Tx Inhibit	A type of transmit carrier default (TCD) which turns OFF the transmitter when the DEMOD/Decoder are in acquisition
RX	Receive	Receiver parameters
Satl	Satellite	Used when displaying the Rate after IFU

Table 3-1. Keypad and Display Abbreviations/Functions (Continued)

Table 3-1. Keypad and Display Abbreviations/Functions (Continued)

Abbreviation	Definition	Refers To: (Description/Function)
		overhead has been added
SCT	Serial Clock Transmit	Clock reference source for V.35 DTE
SCRM	Scrambler	Scrambler and descrambler compatibility of encoder and decoder
SEQ	Sequential	Sequential FEC compatibility of encoder and decoder
SLIP	Slip	That which happens when a buffer has under OR over flowed
SOFT	Software	Used in reference to the current software revision
SRC	Source	Clock generation source
ST	Send Timing	Clock reference source for RS-422 DTE
STA	Station	Station Clock reference
STAT	Status	Transmit, Receive or IFU status
SWP	Sweep	Selection of wide or narrow range for demod acquisition
SYNC	Synchronization	G.732 framing synchronization in framing unit
SYN FREQ	Synthesizer Frequency	Transmit and receive IF frequency
TCD	Transmit Carrier Default	Setup of transmitter output default conditions upon removal and reapplication of power (OFF or LST)
Tx/Rx	Transmit/Receive	Both transmitter and receiver using same source
TX	Transmit	Transmitter parameters
V.35	V.35	CCITT V.35-compatible data scrambler
VIT	Viterbi	Viterbi (K=7) FEC compatibility of encoder and decoder
VER	Version	Revision
422	RS-422	Station Clock input at J9-24, 25 on modem rear panel

A full outline of the menu tree is shown in Figure 3-4 through 3-20 at the end of this section. This tree can be used as a guide to avoid 'trial and error' techniques resulting in trips down the wrong menu path.

NOTE

FDC is continuously reevaluating and improving product performance. The manufacturer reserves the right to provide additional menu selections without notice. As a result, the menu depicted herein may not exactly match the implementation of the unit(s) delivered with this manual. Changes to the manual will be incorporated when major operational differences exist.

3.5.2 Remote Control

Remote control of the SM2900 PLUS is accomplished through J10 on the rear of the modem using serial RS-485 communication at 300, 600,1200, 2400, 4800, 9600 and 19200 baud. Set-up of the M&C/Interface card is required in order to properly implement remote control. Basically, most functions that can be performed locally can also be performed remotely. Exceptions include selection of communication parameters (baud rate, parity, etc.) and clock oscillator calibration.

The RS485 unit address is set via the front panel keypad/display by selecting: PROG-MISC-RS485-ADDR-MODEM. Entering a number from 1 to 255 sets the RS485 communication address. The address set for the MODEM should ALWAYS be used by Host controller to communicate ALL information to and from the SM2900 PLUS. When using the SM2900 PLUS with an IFU and an MS298 M:N Redundancy Switch, the SM2900 PLUS **MUST** be configured to answer on the RS485 bus as two logical addresses. This was done to simplify the programming on the MS298 and is called Phantom Mode. In effect the MS298 sees the SM2900 PLUS as a Fairchild RS485 message format compatible modem, and a "Phantom" P1300 RS485 message format compatible framing unit. (Note: The SM2900 PLUS only supports enough of the P1300 command set in Phantom Mode to let the IFU be controlled by the MS298.) To turn on the Phantom mode select: PROG-MISC-RS485- ADDR-MODE and Enter ON. Once Phantom Mode is turned ON the address of the Modem is the same as set above, however, a second address must now be entered for the Phantom IFU address. This is accomplished by selecting: PROG-MISC-RS485- ADDR-IFU and entering an address 1 to 255.

For a complete discussion of instructions, status messages, message structure, message synchronization, key words etc.; refer to Appendix B, M&C Interface Specification.

3.6 Tx and Rx CLOCK OPTIONS (Figure 3-3)

The SM2900 PLUS has a number of clocking options that increase the flexibility of the unit. These permit use of the modem in applications that previously required special modifications to the hardware or additional equipment. During the option additions a conscious effort was made to have as little impact on those already familiar with the clocking of the SM290. From the Host interface all options still go by the same option number as the SM290. There are subtle differences, however, which may have impact on the user's system. Be sure to read the option description you are using if this unit is replacing an SM290. For consistency, accessing the options from the front panel has been set up to use the same option numbers as the Host interface. A summary of each option is provided at the display by a HELP key in case the user is not in reach of a manual. Transmit and receive each have seven options available. The options presented below and illustrated in Figure 3-3 are accessed from the display menus or the remote serial communication port.

The SM2900 PLUS provides a greatly enhanced set of clock options over the SM290 or the SM290/P1300 combination. Phase locking of asymmetrical data rates in 1 bps increments from 32 Kbps to 4096 Kbps and 2 bps increments above this to 10 Mbps (Station and BUF inputs) is possible. For example it is possible for the Tx data rate to be 64 Kbps and the Rx rate to be locked to this at 200.001 Kbps.

NOTE

Careful attention should be paid to the restrictions of the clock options when using the remote port because there is NO checking for illegal clocking options.

3.6.1 Preferred and Non-Recommended Clocking

Preferred and non-recommended clocking refers to external and internal clocking of data into the SM2900 PLUS. The preferred clocking method is to send the clock along with the data so that timing or phasing of the clock edge relative to the data is maintained. In the non-recommended, but usable, clocking mode a clock is not sent with the data and the timing edge of the internal clock of the SM2900 PLUS is used. The type of clocking in the SM2900 PLUS is established using the INT/EXT selection from the PROG-MISC-CLK-Tx-INT/ENT menu. EXT is preferred and indicates to the SM2900 PLUS that the clock is being delivered with the data external to the unit. That is, SCTE (V.35) or TT (RS422/449) signals are being used. With the INT selection the external clock port (SCTE/TT) is ignored.

In the SM2900 PLUS, the onus of the INT mode is reduced because the unit also has a Tx clock inversion (INV) control so that proper clock data phasing can be maintained with almost any equipment even if it does not conform to standards. Some interfaces, such as

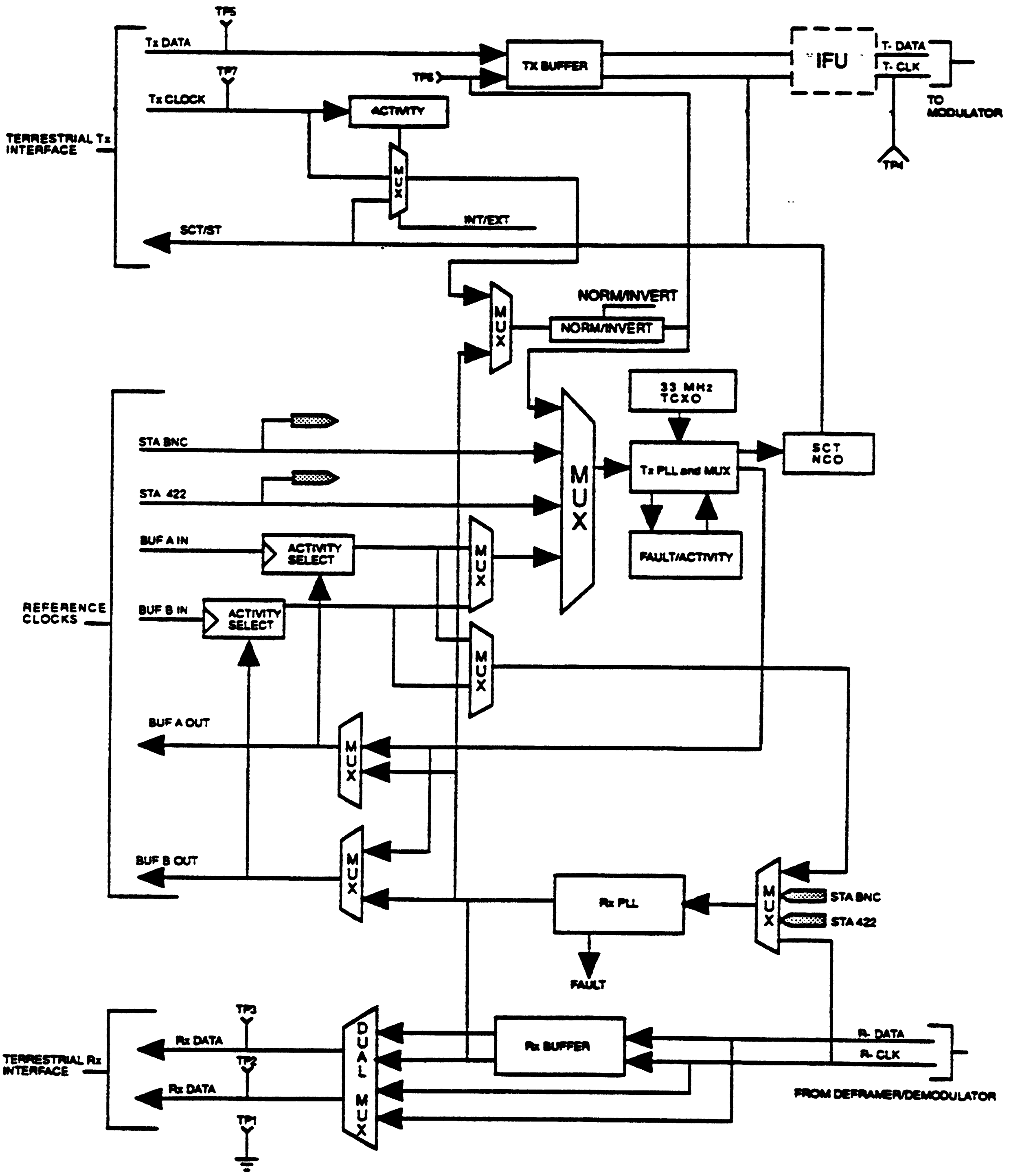


Figure 3-3. Clock Options Diagram

V.11 do not deliver a clock so the INT mode is required. Proper phasing of the clock and data can be checked by using the Tx clock and Tx Data test points on the edge of the M&C card. A positive clock transition in the middle of the data bit is proper. INV (Tx clock inversion) is discussed later.

3.6.2 TX Reference Options

When choosing the transmit option two critical questions figure into the clock option chosen 1) where will the source for the Tx PLL, and consequently the transmit data rate, be coming from, and 2) where will the frequency of that source be specified to the SM2900 PLUS for configuration of the Tx PLL. One of seven clocking options may be selected on the transmit side of the modem fulfilling various answers to the questions above.

3.6.3 Considerations for Tx Opt #1

Setting the Tx Option to #1 indicates to the modem that the user wants the transmit side of the modem referenced to the clock specified by the Tx INT/EXT parameter, where external (EXT) is the clock from the DTE at the Terrestrial interface (SCTE, TT, or equivalent) and internal (INT) is the clock generated in the modem sent to the user as SCT, ST, or equivalent. The frequency of the source for the Tx PLL is implied in this clock option to be the Tx terrestrial data rate.

NOTE

When INT clock is chosen the modem ignores the TT/SCTE clock from the DTE and clocks Tx Data into the Tx FIFO using the modem's internal version of the ST/SCT clock.

1. When using T1 or CEPT, external clock (EXT) is always used as there is no physical way of getting the internally generated clock to the user. The routines involving the keypad enforce this. When writing Host/controller software the clock source must be EXT.

2. With the RS-422, or V.35. interfaces, if the clock from the user is somehow disrupted in EXT mode, the modem will automatically switch to its internal clock and function as if the Tx INT/EXT Clock Source were set to INT until the user's clock returns. This is accomplished with an Activity Detector monitoring the Tx clock signal from the DTE.

3. When choosing INT, only data which is properly aligned with the clock provided to the user (i.e. SCT,ST or equally) will be successfully transmitted. In this mode the user MUST account for propagation delays. Due to critical nature of the clock and data relationships, internal mode is NOT recommended. Selection of the Tx clock inversion to reduce this effect is discussed later.

3.6.4 Considerations for Tx Opt #2

Setting the Tx clock option to #2 indicates to the modem that the user wants the transmit side of the modem phase locked to the Rx PLL. In option #2, therefore, the SCT oscillator is in phase lock with the Rx PLL. The Tx INT/EXT parameter still controls which clock is used to clock the Tx Data into the transmit FIFO. When EXT is chosen the Tx terrestrial clock must be phase locked to either the SCT clock or the Rx terrestrial clock to avoid Tx buffer slips.

The frequency the SM2900 PLUS uses in calculating the Tx PLL setup in option #2 is the Rx terrestrial data rate.

NOTE

When INT clock is chosen the modem ignores the TT/SCTE clock from the DTE and CLOCKs Tx Data into the Tx FIFO using the modem's internal version of the ST/SCT which is locked to the Rx clock.

1. When the Tx clock option is set to #2 the Rx clock option must NOT be set to #1, (see Rx clock options) as this would be a contradiction (Tx=Rx and Rx=Tx).

3.6.5 Considerations for Tx option #3 (i.e., 290 Station Clock compatible mode)

NOTE

Options using Sta 422 refers to the RS422 compatible clock which is received on the fault connector (J10). It does not refer to the RS422/449 Terrestrial Interface.

When the Tx clock option is #3, it means that the user intends Tx to be referenced to a station clock which is at the frequency of the Tx data rate. Which station clock input used is chosen by the 290 STA menu from the keypad or the CKx3_____* parameter of the Host Port. The 422 refers to the stable clock input by the user at the Fault Connector J10 on the rear of the modem which is a Differential input at RS422 levels. The BNC refers to the stable clock input by the user at the J2 STA CLK BNC connector on the rear of the modem.

1. The frequency input to Station Clock chosen when this option is active MUST be at the Tx Data rate.

2. When using RS-422 or V.35, the internal clock will also reference to the Station Clock source selected. The internal clock supplied by the modem (SCT, or ST) is derived from the Station Clock.

. When the Tx and Rx clock options are both #3 the user is to ensure the terrestrial data rates match.

. This option may not be chosen without setting the STA 290 parameter to BNC or 422 so the modem knows which input is to be used.

.6.6 Considerations for Tx Opt #4

etting the Tx clock option to #4 indicates to the modem at the transmit clock is to be phase locked to the clock put at the J10 BUFA inputs. In option #4, the fre- jency at the BUFA input is specified by the user via the enus or the serial Host interface. The Tx INT/EXT arameter still controls which clock is used to clock the Data into the transmit FIFO. When EXT is chosen the terrestrial clock must be phase locked to either the CT,ST clock or the clock being input at the BUFA puts of the J10 fault connector to avoid Tx buffer slips.

ne legal selectable input frequency range is 32 KHz to)96 KHz in 1 Hz steps, and 4096.002 KHz to 10 MHz 2 Hz steps. The primary purpose of option #4 is for use the MS298 M:N Redundancy Switch. It is docu- ented here primarily for thoroughness and in case an oplication were to arise where it may be useful.

When no clk is applied to the BUFA inputs an activity detector routes the BUFA OUT clock internally to replace it.

6.7 Considerations for Tx Opt #5

etting the Tx clock option to #5 indicates to the modem at the transmit clock is to be phase locked to the clock out at the J9 BUFB inputs. In option #5 the frequency the incoming clock is specified by the menus or the rial Host interface. The Tx INT/EXT parameter still ntrols which clock is used to clock the Tx Data into the insmit FIFO. When EXT is chosen, the Tx terrestrial ock must be phase locked to either the SCT,ST clock the clock being input at the BUFB inputs of the J9 fault nnector to avoid Tx buffer slips.
ie legal selectable input frequency range is 32 KHz to 96 KHz in 1 Hz steps, and 4096.002 KHz to 10 MHz 2 Hz steps.

otion #5 is present for future enhancement. It too is cumented here primarily for thoroughness and in se an application were to arise where it may be useful.

When no clk is applied to the BUFB inputs an activity detector routes the BUFB OUT clock internally to replace it.

.8 Considerations for Tx Opt #6

tting the Tx clock option to #6 indicates to the modem it the transmit clock is to be phase locked to the clock input at the J9 STA 422 inputs. In option #6 the frequency is specified by the user via the menus or the serial Host interface. The Tx INT/EXT parameter still controls which clock is used to clock the Tx Data into the transmit FIFO. When EXT is chosen the Tx terrestrial clock must be phase locked to either the SCT,ST clock or the clock being input at the STA CLK inputs of the J10 fault connector to avoid Tx buffer slips.
The legal selectable input frequency range is 32 KHz to 4096 KHz in 1 Hz steps, and 4096.002 KHz to 10 MHz in 2 Hz steps.

1. This option will also be referred to as the Station CLK A input. Thus the parameter controlling the frequency used for Tx PLL calculations is SA________*.

3.6.9 Considerations for Tx Opt #7

Setting the Tx clock option to #7 indicates to the modem that the transmit clock is to be phase locked to the clock input at the J2 STA CLK (BNC) input. In option #7 the frequency is specified by the user via the menus or the serial Host interface. The Tx INT/EXT parameter still controls which clock is used to clock the Tx Data into the transmit FIFO. When EXT is chosen the Tx terrestrial clock must be phase locked to either the SCT,ST clock or the clock being input at the J2 STA CLK connector to avoid Tx buffer slips.

The legal selectable input frequency range is 32 KHz to 4096 KHz in 1 Hz steps, and 4096.002 KHz to 10 MHz in 2 Hz steps.

1. This option will also be referred to as the Station clk B input. Thus the parameter controlling the frequency used for Tx PLL calculations is SB________*.

3.7 RX REFERENCE OPTIONS

For the Rx reference to be different from the clock which is recovered from the satellite the Rx Buffer MUST BE On.

When choosing the receive clock option two critical questions figure into the clock option chosen 1) where will the source for the Rx PLL, and consequently the receive data terrestrial rate be coming from if the Rx buffer is ON, and 2) where will the frequency of that source be specified to the SM2900 PLUS for configu- ration of the Rx PLL. One of seven clocking options may be selected on the receive side of the modem fulfilling various answers to the questions above.

3.7.1 Considerations for Rx Opt #1

Setting the Rx Option to #1 indicates to the modem that the user wants the receive terrestrial data output from the modem phase locked to the Tx PLL. The frequency of the source for the Rx PLL is implied in this clock option to be the Tx terrestrial data rate.

1. When the Rx clock option is #1, the Tx clock option must NOT be #2. This is an illegal combination and is locked out from the menus, however, the Host/ controller software MUST program it correctly.

2. The Rx clock sent to the user in this mode will be synchronous to Tx if the Rx Buffer is ON.

NOTE
If the Rx buffer is NOT ON the receive terrestrial date will be output at the Satellite Rate.

3.7.2 Considerations for Rx Opt #2

Setting the Rx clock option to #2 indicates to the modem that the user wants the receive terrestrial data output in phase lock with clock being recovered with the data from the satellite.

The frequency used in calculating the Rx PLL setup in option #2 is the Rx satellite rate.

1. Turning the Rx Buffer On in this mode when the IFU is NOT active puts a delay in the data only. The data is still clocked out of the Rx buffer synchronously with Rx Clock. The number of bits delay is equal to the length of the Rx Buffer in bits.

3.7.3 Considerations for Rx option #3 (i.e., 290 Station Clock compatible mode)

See the note concerning the 422 STA CLK under Tx option #3.

When the Rx clock option is #3 it means that the user intends Rx to be referenced to a station clock which is at the frequency of the Rx data rate. Which station clock input used is chosen by the 290 STA menu or the CKx_3____* parameter of the keypad and Host port respectively. The 422 refers to the stable clock input by the user at the Fault Connector J10 on the rear of the modem which is a Differential input at RS422 levels. The BNC refers to the stable clock input by the user at the J2 STA CLK BNC connector on the rear of the modem.

1. The frequency input to the station clock chosen by the user MUST be at the Receive Data Rate.

2. The Rx clock sent to the user in this mode will only be synchronous to Station Clock if the Rx Buffer is ON.

3. When the Tx and Rx clock options are both #3 the user is to ensure the terrestrial data rates match.

4. This option may not be chosen without setting the STA 290 parameter to BNC or 422 so the modem knows which input is to be used.

3.7.4 Considerations for Rx Opt #4

Setting the Rx clock option to #4 indicates to the modem that the Rx PLL is to be phase locked to the clock input at the J10 BUFA inputs. In option #4 the frequency is specified by the user via the menus or the serial Host interface. For the data at the terrestrial interface to make use of this option the Rx buffer MUST BE ON.

The legal selectable input frequency range is 32 KHz to 4096 KHz in 1 Hz steps, and 4096.002 KHz to 10 MHz in 2 Hz steps. The primary purpose of option #4 is for use by the MS298 M:N Redundancy Switch. It is documented here primarily for thoroughness and in case an application were to arise where it may be useful.

1. When no clk is applied to the BUFA inputs an activity detector routes the BUFA OUT clock internally to replace it.

3.7.5 Considerations for Rx Opt #5

Setting the Rx clock option to #5 indicates to the modem that the Rx PLL is to be phase locked to the clock input at the J9 BUFB inputs. In option #5 the frequency of the incoming clock is specified by the menus or the serial Host interface. As with options prior to this, for the data at the terrestrial interface to make use of this option the Rx buffer MUST BE ON.

The legal selectable input frequency range is 32 KHz to 4096 KHz in 1 Hz steps, and 4096.002 KHz to 10 MHz in 2 Hz steps.

Option #5 is present for future enhancement. It too is documented here primarily for thoroughness and in case an application were to arise where it may be useful.

1. When no clk is applied to the BUFB inputs an activity detector routes the BUFB OUT clock internally to replace it.

3.7.6 Considerations for Rx Opt #6

Setting the Rx clock option to #6 indicates to the modem that the Rx PLL is to be phase locked to the clock input at the J9 STA 422 inputs. In option #6 the frequency is specified by the user via the menus or the serial Host interface. As with options prior to this, for the data at the terrestrial interface to make use of this option the Rx buffer MUST BE ON.

ıe legal selectable input frequency range is 32 KHz to)96 KHz in 1 Hz steps, and 4096.002 KHz to 10 MHz 2 Hz steps.

This option will also be referred to as the Station clk A input. Thus the parameter controlling the frequency used for Rx PLL calculations is SA________*.

.7.7 Considerations for Rx Opt #7

etting the Rx clock option to #7 indicates to the ıodem that the Rx PLL is to be phase locked to the ock input at the J2 STA CLK (BNC) input. In option #7 ıe frequency is specified by the user via the menus or ıe serial Host interface. As with options prior to this, for ıe data at the terrestrial interface to make use of this ption the Rx buffer MUST BE ON.

This option will also be referred to as the Station clk B input. Thus the parameter controlling the frequency used for Rx PLL calculations is SB________*.

.8 TRANSMIT CLOCK INVERSION OFF/ON

he SM2900 has a provision for inverting the Tx clock ıside the modem. This provides flexibility to easily dapt the unit to equipment that delivers a Tx clock out f phase and to help when interfacing the SM2900 to ›TE when the INT (Internal) clock selection is made nd Tx clock is not sent with the Tx data. The selection ; made adjacent to the clock options menu, or by ntering from the main menu: PROG-MISC-CLK-Tx-ıV and selecting the inversion OFF (normal opera-on) or ON to invert the Tx clock. Clock phasing can be bserved at test points on the M&C card; TP6 is the lock used to clock in transmit data, and TP5 is Tx)ATA. Proper clocking occurs when the positive ansition of the clock is in the middle of the Tx data.

.9 Rx BUFFER OPTION (ALSO SEE APPENDIX C)

'he Rx buffer is turned ON whenever bits or ms is hosen from the PROG RX BUF ON/OFF menu. It may lso be turned ON or OFF via the serial Host interface.)ata enters the Rx buffer from the DEMOD when the ⁼U option is NOT installed, and from the deframing unit ʼhen the IFU option IS installed. When the IFU is NOT ıstalled the clock recovered by the DEMOD, from the atellite, clocks the data into the receive buffer. For larity then, without the IFU option, data enters the eceive buffer at the satellite data rate. When the IFU ption is installed, the satellite clock and data pass ırough the deframing unit. When the IFU is in bypass BYPS) the deframing unit passes the satellite clock ınd data directly through to the receive buffer. In IBS, DR or G732 modes the deframing unit removes the raming data information and their respective clocks from the data and clock streams, before passing them on to the receive buffer. The result is an effect referred to as punctured clock and data. The data is clocked into the receive buffer at the satellite rate as above, but there are punctures, or gaps, where the framing information and clocks have been removed from. Turning the receive buffer OFF while one of the framing modes are active will allow the user to observe this punctured clock and data at the TP2 and TP3 test points on the M&C card.

Data is clocked from the buffer by the output of the Rx PLL. See RX Clock Options section for more information. When the Rx buffer is ON, data clocked from the Rx buffer is sent to the user via the Terrestrial interface on the rear panel of the modem.

A slip of the receive buffer can be an underflow or an overflow which causes the buffer to recenter.

NOTE

When using the buffer in Opt #1 the buffer size entered IS the actual end to end buffer size. In all other options the buffer size specified is the length of the slip or end to center buffer size.

When setting the size of the receive buffer, make sure you are aware of the slip and N/455 options. These two will silently cause you the most confusion if you are not aware of their existence. When the user chooses one of the predetermined slip options the receive buffer is forced to slip on multiples of that predetermined length. As an example, when Slip option #3 is active the receive buffer is forced to slip in multiples of 4632 bits. When the user tries to change the size of the buffer it will force the buffer size to the first multiple of 4632 bits EQUAL to or LARGER than the size input. Another option added to the SM2900 is the N/455 option. This option many of you will already be using to calculate minimum buffer lengths yourself, but on the SM2900 it CAN be automatic. When the N/455 option is active the buffer size is not allowed to be fewer in bits than: DATA RATE in bits-per-second divided by 455. Leaving this option active will eliminate most buffer sizes too small to compensate for satellite drift. With either of these options active (without the user aware), confusion begins when the size of the buffer cannot be set to a size that violates the definition of the options. If this is happening, PROG-Rx-BUF-SLIP-OPT from the Keypad/display interface. Set the option to #1 which will allow setting the size of the buffer with 8 bit resolution from 80 to 65536 bits. Then PROG-Rx-BUF-SLIP-N/455 from the Keypad/display interface to OFF. With both of these options disabled, the size of the buffer may now be set with 8-bit resolution. All receive buffer sizes will be adjusted to the first size in bits divisible by 8.

NOTE
The minimum buffer size is 80 bits.

Using the buffer in **ms** mode allows the user to enter the the buffer size in milliseconds while all of the above options and modes still apply. The buffer calculations use the data rate to convert ms to bits and everything above still applies. The user must be aware that with the slip options or N/455 mode active the size is adjusted at the bit level and displayed to the nearest millisecond to the display or host interfaces.

3.10 BER VERSUS Eb/No

Operational performance of this equipment will be degraded if it is used in a situation in which the adjacent channel separation specification is not followed. See Appendix A for this information. The specification describes the power handling capability of the Demodulator with respect to the specific carrier; i.e., the total power other than the primary carrier.

Tables 3-2 through 3-4 show the relationships between carrier plus noise-to-noise, (C+N)/N carrier-to-noise, (C/N) and Eb/No. The modem performance is specified in Bit Error Rate (BER) versus Eb/No, and the tables can be used to check performance for modems with 1/2 rate, 3/4 rate and 7/8 rate coding.

(C+N)/N can be measured using a spectrum analyzer while looking at the received signal from a transponder, or from a laboratory noise test set. However, measurement error of several tenths dB are not uncommon using even high-quality, calibrated spectrum analyzers. If very accurate measurement of BER performance is required, laboratory measurement using a calibrated noise bandwidth standard filter, noise test set, and power meter is required. It is important to remember, when measuring (C+N)/N of a modulated spectrum using a spectrum analyzer, that the resolution bandwidth of the spectrum analyzer must be small compared to the spectral bandwidth of the signal in question.

3.11 Spectrum Inversion

Controls for inverting the signal spectrum, i.e., changing the rotational sense of the QPSK constellation, are contained on both the modulator and demodulator PWB assemblies. IDR, IBS, and ESC applications require specific rotational sense, and inversion of the spectrum in these applications should be avoided. However, in some closed network applications, inversion of the spectrum at either the modulator, or demodulator or both, may be required for compatibility with other manufacturer's equipment.

On the modulator, the jumper at TP22 must be in placefor normal rotation. Removing the jumper, or just inserting the jumper over one of the test point pins will cause the transmitted spectrum to be inverted. On the demodulator, the jumper at TP11 must be placed in the NORM position for normal rotation. Move the jumper to the INV position for inverted spectrum processing. Refer to Sections 2.8.1 and 2.9.1.

3.12 Demodulator Data Rate Programming

If the SM2900 PLUS demodulator is not configured with the dual Nyquist filter plug-in module, the demod data rate is limited to 2304 Kbps for 1/2 rate Viterbi and 3456 Kbps for 3/4 rate Viterbi. It is limited to 2304 Kbps for all sequential code rates regardless of whether or not the filter plug-in module is installed. The demod only has access to the data rate agile digital Nyquist filter. The programming menu tree for demod data rate as shown in Figure 3-14 only shows the current data rate and the option for entering a new data rate. Attempts to program data rate and code rate combinations that result in either the data rate being out of bounds or the symbol rate being out of bounds will result in an illegal data rate error message. Reprogramming code rate before changing the data rate may be required in order to configure for some combinations. For example, if the demod is currently programmed for 1/2 rate Viterbi at 1024 Kbps, an attempt to change the data rate to 3088 Kbps will result in the error message because the symbol rate as programmed will exceed 2304 KHz. But, if the code rate is first changed to 3/4 rate Viterbi, then the data rate of 3088 Kbps will be accepted. Similar conflicts will result on the low data rate end if an intermediate configuration results in symbol rate below the minimum.

When the SM2900 PLUS demodulator is configured with the dual Nyquist filter plug-in module, two symbol rates above 2304 KHz are available with K=7 Viterbi decoding. The M&C software reads a PROM located on the filter module to identify the symbol rates available from the A and B filters on the plug-in module. It will accept data rate and code rate combinations that result in symbol rates within 5% of the nominal rates for the filters. The demod data rate programming menu, as shown in Figure 3-14, is altered when the filter module is installed to include a help feature that shows the nominal data rate for each filter and the maximum and minimum allowable data rates for each filter. The data rate displayed in the menu is based on the currently programmed code rate, and will change if the code rate is changed. To change code rate while using the high data rate filters, first program the demod data rate below 2304 Kbps to temporarily access the data rate agile digital Nyquist filter. This will avoid an intermediate symbol rate that does not match either the A or B filters. Change code rate and then program data rate above 2304 Kbps as allowed for either the A or B filter.

3.13 PROGRAMMING SM2900 PLUS OPERATING MODES

3.13.1 IBS OPERATION

To program the SM2900 PLUS for operation in IBS mode, the items listed below are selected using the front panel keypad and LCD display or are programmed from the RS485 interface. The items listed below are shown as they appear in the menus accessed from the front panel, and indented to show how far down they are in the display tree hierarchy. Entries are either selected with function keys F1 through F2 or using the numeric keys followed by depressing the ENTER key to accept.

- **PROG**
  - **MISC**
    - **CLK**
      - **Tx**
        - **OPT** - Initial setup select OPTION # 1. Refer to section on Clock Options for clocking arrangements.
        - **INT EXT** - Initial setup select EXT.
        - **Tx CLK INVERT** - Select OFF
      - **Rx**
        - **OPT** - Initial setup select OPTION # 2. See Clock Options Section for further explanation.
      - **FREQ** - Initial setup make no selection. See Clock Options Section.
      - **290 STA CLK is** - Initial setup select NONE. See Clock Options Section.
  - **MISC**
    - **INTFC** (Only for T1 or CEPT / G.703, 2048 Kbps)
      - **LINE CODE** - AMI or B8ZS allowed for T1 and AMI or HDB3 allowed for CEPT.

- **PROG**
  - **Tx**
    - **DATA**
      - **RATE** - Program the terrestrial data rate. (The FRAMING TYPE and ENCoding may need to be changed if the data rate is not accepted).
      - **ENC**
        - **TYPE** - Select VIT
        - **RATE** - Select 1/2 or 3/4 depending upon type of IBS service.
        - **DIFF** - Select ON
      - **SCRM - OFF-** IBS scrambling is selected under the FRAM menu below.
  - **Tx**
    - **CARR**
      - **FREQ** - Enter the Tx IF frequency in MHz (50 - 180 MHz in 2.5 KHz steps).
      - **PWR**
        - **LVL** - Enter the level (-5 to -20 dBm in 0.1 dB steps).
        - **ON/OFF** - Select ON
      - **TCD** (Transmit Carrier Default) - Initial select LST (last). If **OFF** is chosen then the Tx carrier will be disabled when either reset is applied or if prime power is cycled.
      - **PURE** - Select **OFF**.

- **PROG**
  - **Rx**
    - **DATA**
      - **RATE** - Enter the Terrestrial Data rate. (The DeFRAMingTYPE and DECoding may need to be changed if the data rate is not accepted).
      - **DEC**
        - **RATE** - Select 1/2 or 3/4 depending upon type of IBS service.
        - **DIFF** - Select **ON**.
      - **SCRM - OFF**. IBS scrambling is selected under the DFRAM menu below.
    - **CARR** - Enter the Rx IF frequency in MHz (50 - 180 MHz in 0.1 KHz steps)

BUF
- **ON/OFF** - Initial setup select **OFF**. See section on Rx Buffer for further description.
- **SIZE** - No entry required with Buffer OFF. See Rx Buffer section.
- **SLIP** - No entry required with Rx Buffer OFF. See Rx Buffer section.
- **RCNTR** - No entry required with Rx Buffer OFF. See Rx Buffer section.

PROG
- **IFU**
  - **FRAM**
    - **TYPE** - Select IBS (1/15 Overhead), G.732 is 0% OH added to 2048
    - **SCRM** - IBS SCRAMBLER = ON
    - **AIS**
      - **LOS** - Set to OFF (disables monitoring of the G.732 frame sync)
      - **SYNC** - Not Available (G.732 Only)
    - **FLT**
      - **LOS** - Set to OFF
      - **SYNC** - Not Available (G.732 Only)
  - **DFRAM**
    - **TYPE** - Select IBS (1/15 Overhead).
    - **SCRM** - IBS SCRAMBLER = **ON**
    - **AIS** - Set to OFF
    - **FLT** - Set to OFF

3.13.2 IDR OPERATION

To set the SM2900 PLUS for operation in IDR mode the items listed below are selected using the front panel keypad and LCD display or are programmed from the RS485 interface. The items listed below are shown as they appear in the menus accessed from the front panel, and indented to show how far down they are in the display tree hierarchy. Entries are either selected with function keys F1 through F2 or using the numeric keys followed by pressing the **ENTER** key to accept.

PROG
- **MISC**
  - **CLK**
    - **Tx**
      - **OPT** - Initial setup select **OPTION # 1**. Refer to section on Clock Options for clocking arrangements.
      - **INT EXT** - Initial setup select **EXT**. See Clock Options Section
      - **TX CLK INVERT** - Select **OFF**. See Clock Options Section.
    - **Rx**
      - **OPT** - Initial setup select **OPTION # 2**. See Clock Options Section.
    - **FREQ** - Initial setup make no selection. See Clock Options section.
    - **290 STA CLK Is** - Initial setup select **NONE**. See Clock Options section.
- **MISC**
  - **INTFC** (Only for T1 or CEPT / G.703, 2048 Kbps)
    - **LINE CODE** - AMI or B8ZS allowed for T1 and AMI or HDB3 allowed for CEPT.
    - **LINE LENGTH** - Set to current cable length (T1 Only)

PROG
- **Tx**
  - **DATA**
    - **RATE** - Program the terrestrial data rate in Kbps. (The FRAMing TYPE and ENCoding may need to be changed if the data rate is not accepted).
    - **ENC**
      - **TYPE** - Select **VIT**.
      - **RATE** - Select **3/4**.
      - **DIFF** - Select **ON**.
    - **SCRM - V.35**

Tx
CARR
FREQ - Enter the Tx IF frequency in MHz (50 - 180 MHz in 2.5 KHz steps).
PWR
LVL - Enter the level (-5 to -20 dBm in 0.1 dB steps).
ON/OFF - Select ON
TCD (Transmit Carrier Default) - Normally select LST (last). If OFF is chosen, the Tx carrier will be disabled when either reset is applied or if prime power is cycled.
PURE - Select OFF.

OG
Rx
DATA
RATE - Enter the terrestrial data rate in Kbps. (The DeFRAMing TYPE and DECoder type may need to be changed if the data rate is not accepted).
DEC
RATE - Select 3/4.
DIFF - Select ON.
SCRM - V.35
CARR - Enter the Rx IF frequency in MHz (50 - 180 MHz in 0.1 KHz steps)
BUF
ON/OFF - Initial setupselect OFF. See section on Rx Buffer for further description.
SIZE - No entry required with Buffer OFF. See Rx Buffer section.
SLIP - No entry required with Rx Buffer OFF. See Rx Buffer section.
OPT - Set option to #1
LENGTH - Not Active
N/455 - Set to OFF
RCNTR - No entry required with Rx Buffer OFF. See Rx Buffer section.

PROG
IFU
FRAM
TYPE - Select IDR (96 Kbps Overhead)
SCRM - IBS SCRAMBLER = OFF
AIS
LOS - Turn OFF
SYNC - Not Available (G.732 Only)
FLT
LOS - Turn OFF
SYNC - Not Available (G.732 Only)
DFRAM
TYPE - Select IDR (96 Kbps Overhead).
SCRM - IBS SCRAMBLER = OFF
AIS - Set to OFF
FLT- Set to OFF

4 SM2900 PLUS STATUS AND FAULTS

ed summary fault LED visible from the front panel is located on the front of the three main modules indicating status of each module. These are available as an aid for fault isolation and unit status. A green LED is located the demodulator card which indicates the demodulator/decoder is locked. A green LED for carrier detect can viewed by opening the front panel of the SM2900 PLUS. A more detailed summary of the unit status is provided the LCD display. The status menu is reached by pressing CHK STAT. Below is a listing of the alarms/faults ng with a description.

DATA

-MOD FLT -Indicates a lack of activity in the data entering the modulator.
-FIR FLT -Lack of activity in the data exiting the FIR filter which shapes the data before it enters the modulator.

Tx DATA

-MOD FLT	-Indicates a lack of activity in the data entering the modulator.
-FIR FLT	-Lack of activity in the data exiting the FIR filter which shapes the data before it ente the modulator.
-SYM FLT	-Indicates fault in mod symbol clock phase locked loop.
-OVR FLT	-Indicates fault in mod over sample clock phase locked loop.

Tx CARRier

-SYN 1 FLT	-Failure in synthesizer 1 of the modulator.
-SYN 2 FLT	-Failure in synthesizer 2 of the modulator.
-AGC FLT	-Failure in the modulator AGC.

Tx CLocK

-SCT FLT	-The SCT / ST clock has failed for no activity.
-LOC FLT	-Loss of terrestrial clock input
-LOS FLT	-On AMI Interfaces means no input terrestrial signal.
-TRC FLT	-Tx clock after the Tx mux has no activity.
-TXL FLT	-The Tx PLL is not locked.
-FRAM FLT	-Tx frame clock has no activity.
-MOD FLT	-The Tx clock to the modulator has failed.

Rx DATA

-DECODER UNLOCKED	-The Viterbi or sequential decoder is unlocked. Lock is also indicated by the green LEI on the demodulator card. When the decoder is locked the uncorrected (RAW), corrected and Eb/No are displayed.

Rx CARRier

-AGC LOW FLT	-The level of the incoming carrier has fallen below approximately -62 dBm. This is nc a critical alarm and the demodulator will operate below this level.
-AGC HI FLT	-The level of the incoming carrier has increased above approximately -33 dBm. This i: not a critical alarm and the demodulator will operate above this level.
-SYN FLT	-The demodulator synthesizer has failed.
-FREQ	-Actual frequency measured in Demod Carrier recovery loop (to the nearest 100 Hz)

Rx CLK

-SYM FLT	-The Rx symbol recovery loop is unlocked.
-BIT FLT	-The bit clock on the decoder is faulted.
-DEC FLT	-The decoder clock is not locked.
-RRC FLT	-Rx reference clock out of the Rx mux has no activity.
-RXL FLT	-The Rx PLL is not locked.
-RXC FLT	-The Rx clock clocking out the terrestrial side of the Rx Buffer has no activity.

Rx BUFFer

-Rx BUFFER FLT	-The Rx Buffer has slipped (over or underflow). This message appears on the display for approximately 0.5 sec.

IFU FRAME

-IFU Tx FIFO FLT	-The Tx FIFO has slipped (over or underflow). This message appears on the display for approximately 0.5 sec.
-G.732 SYNC	-(G.732 Mode Only) Tx terrestrial data is not formatted to G.732. Fault is also part of Tx TTL and Tx form-C relay on the fault connector.
-G.732 SYNC ALM	-(G.732 mode only) Tx terrestrial data is not formatted to G.732. A fault is also indicated on the fault connector.

IFU DEFRAME

-IBS BAK ALM FLT	-Indicates the far end receiver has faulted and has returned this message to the near end for display (IBS operation).
-IDR BAK ALMs 1 thru 4	-Backward alarm 1 thru 4 is individually indicated (IDR operation).

IFU DEFRAME SYNC

-FRAME SYNC FLT	-Synchronization of the satellite framing (IBS/SMS/IDR) is lost.
-MULTIFRAME SYNC FLT	-Synchronization of multiframe from the satellite is lost (IBS/SMS only)
-FRAME BER FLT	-The BER measured on the overhead exceeds 10^{-3}.

Table 3-2. Carrier Plus Noise-to-Noise Conversion Chart for Rate 1/2 Coding

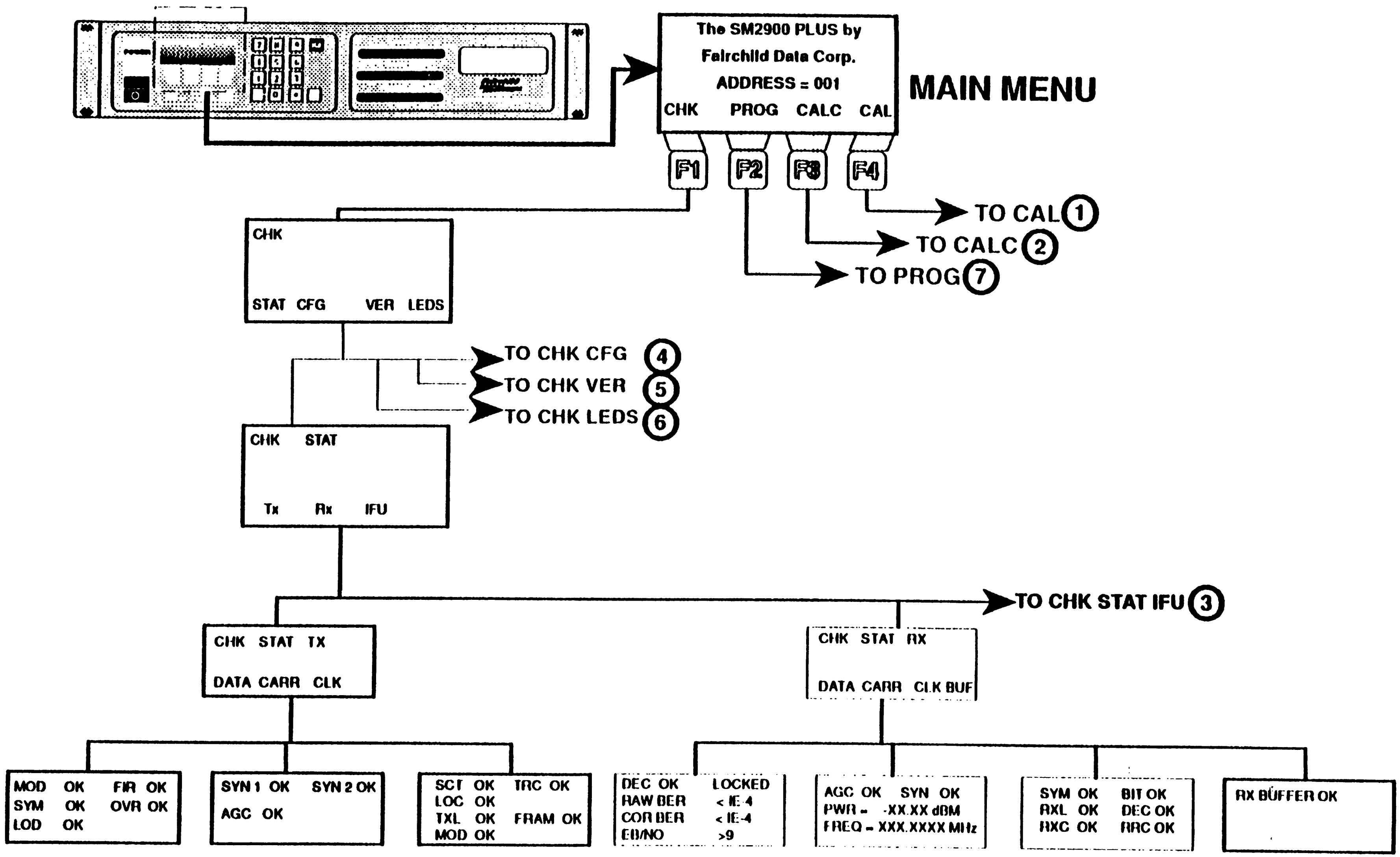
C+N/N	C/N	Eb/No
5.0	3.3	3.3
5.5	4.1	4.1
6.0	4.7	4.7
6.5	5.4	5.4
7.0	6.0	6.0
7.5	6.6	6.6
8.0	7.3	7.3
8.5	7.8	7.8
9.0	8.4	8.4
9.5	9.0	9.0
10.0	9.5	9.5
10.5	10.1	10.1
11.0	10.6	10.6
11.5	11.2	11.2
12.0	11.7	11.7
12.5	12.2	12.2
13.0	12.8	12.8
13.5	13.3	13.3
14.0	13.8	13.8
14.5	14.3	14.3
15.0	14.9	14.9
15.5	15.4	15.4
16.0	15.9	15.9
16.5	16.4	16.4
17.0	16.9	16.9
17.5	17.4	17.4
18.0	17.9	17.9
18.5	18.4	18.4
19.0	18.9	18.9
19.5	19.5	19.5
20.0	20.0	20.0
20.5	20.5	20.5
21.0	21.0	21.0
21.5	21.5	21.5
22.0	22.0	22.0
22.5	22.5	22.5
23.0	23.0	23.0
23.5	23.5	23.5
24.0	24.0	24.0
24.5	24.5	24.5
25.0	25.0	25.0

Table 3-3. Carrier Plus Noise-to-Noise Conversion Chart for Rate 3/4 Coding

C+N/N	C/N	Eb/No
5.0	3.3	1.6
5.5	4.1	2.3
6.0	4.7	3.0
6.5	5.4	3.6
7.0	6.0	4.3
7.5	6.6	4.9
8.0	7.3	5.5
8.5	7.8	6.1
9.0	8.4	6.7
9.5	9.0	7.2
10.0	9.5	7.8
10.5	10.1	8.3
11.0	10.6	8.9
11.5	11.2	9.4
12.0	11.7	10.0
12.5	12.2	10.5
13.0	12.8	11.0
13.5	13.3	11.5
14.0	13.8	12.1
14.5	14.3	12.6
15.0	14.9	13.1
15.5	15.4	13.6
16.0	15.9	14.1
16.5	16.4	14.6
17.0	16.9	15.2
17.5	17.4	15.7
18.0	17.9	16.2
18.5	18.4	16.7
19.0	18.9	17.2
19.5	19.5	17.7
20.0	20.0	18.2
20.5	20.5	18.7
21.0	21.0	19.2
21.5	21.5	19.7
22.0	22.0	20.2
22.5	22.5	20.7
23.0	23.0	21.2
23.5	23.5	21.7
24.0	24.0	22.2
24.5	24.5	22.7
25.0	25.0	23.2

Table 3-4. Carrier Plus Noise-to-Noise Conversion Chart for Rate 7/8 Coding

C+N/N	C/N	Eb/No
5.0	3.3	0.9
5.5	4.1	1.6
6.0	4.7	2.3
6.5	5.4	3.0
7.0	6.0	3.6
7.5	6.6	4.2
8.0	7.3	4.8
8.5	7.8	5.4
9.0	8.4	6.0
9.5	9.0	6.6
10.0	9.5	7.1
10.5	10.1	7.7
11.0	10.6	8.2
11.5	11.2	8.8
12.0	11.7	9.3
12.5	12.2	9.8
13.0	12.8	10.3
13.5	13.3	10.9
14.0	13.8	11.4
14.5	14.3	11.9
15.0	14.9	12.4
15.5	15.4	12.9
16.0	15.9	13.5
16.5	16.4	14.0
17.0	16.9	14.5
17.5	17.4	15.0
18.0	17.9	15.5
18.5	18.4	16.0
19.0	18.9	16.5
19.5	19.5	17.0
20.0	20.0	17.5
20.5	20.5	18.0
21.0	21.0	18.5
21.5	21.5	19.0
22.0	22.0	19.5
22.5	22.5	20.0
23.0	23.0	20.5
23.5	23.5	21.1
24.0	24.0	21.6
24.5	24.5	22.1



Menus shown are typical. Some menus change depending upon program input or changes in unit status. Menu presentation may change as enhancements or upgrades are incorporated into the unit.

Figure 3-4. Main Menu at Power-Up.

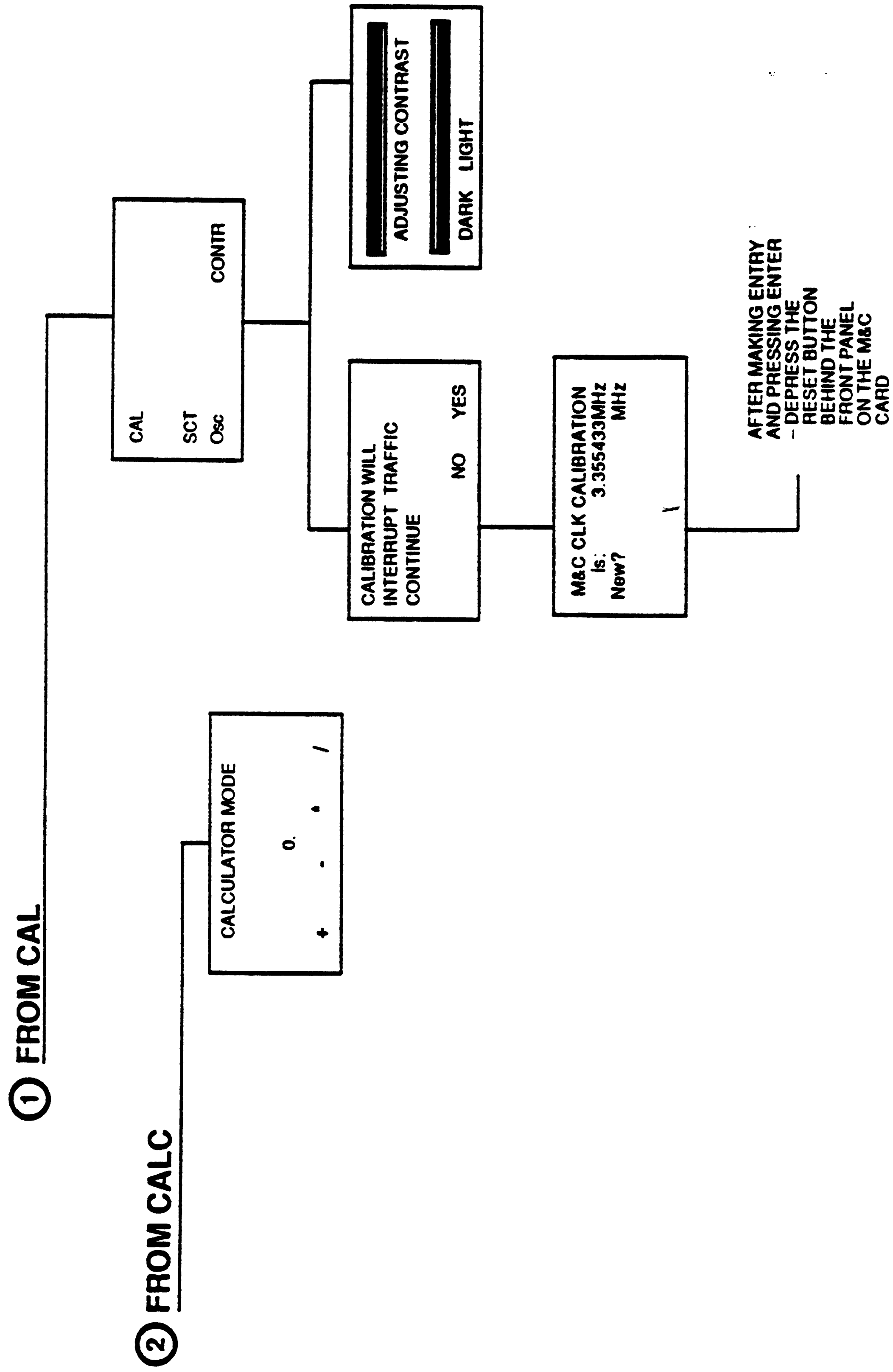


Figure 3-5. Calibrating M&C, Adjusting Contrast and Calculator Mode

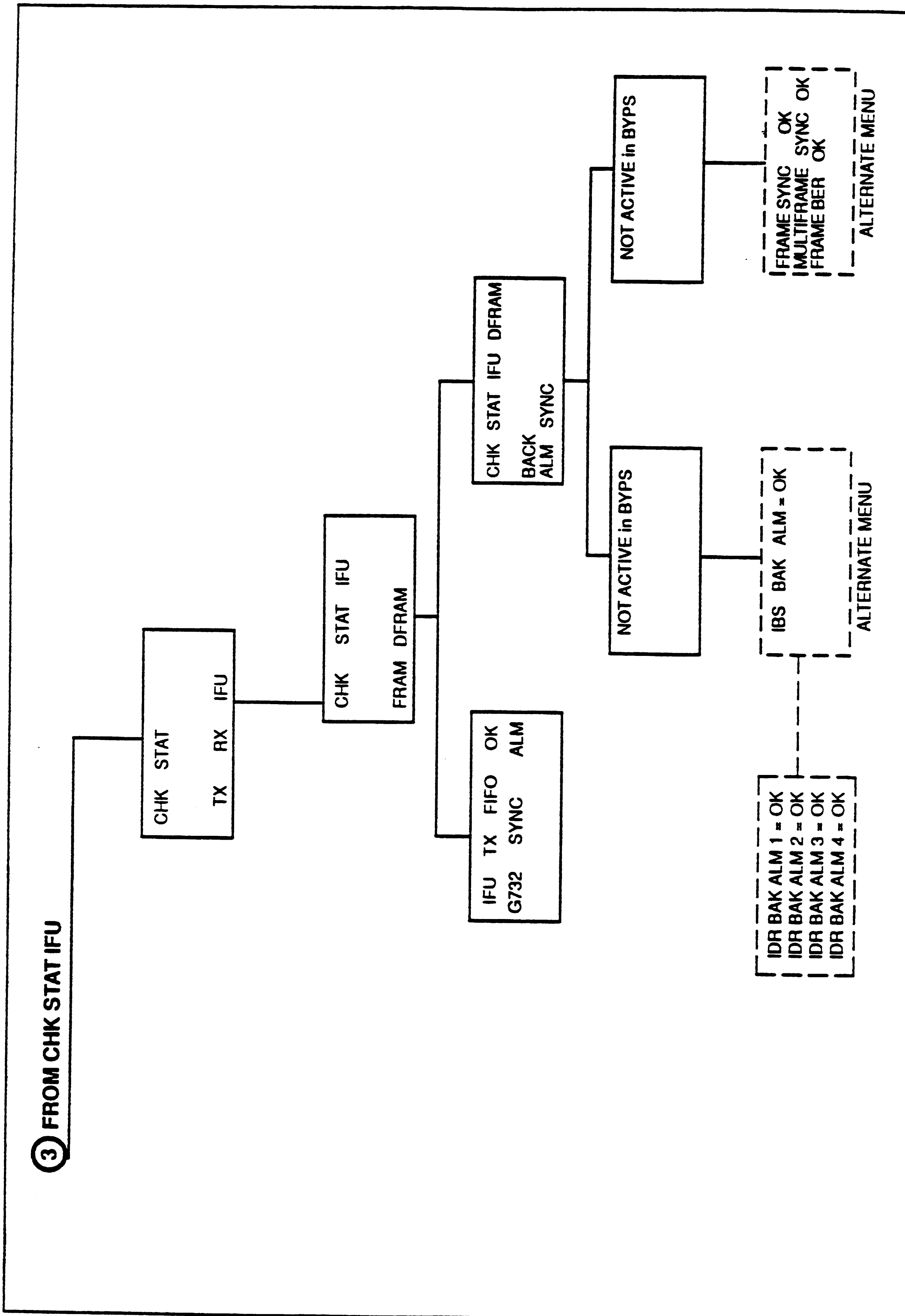


Figure 3-6. Checking IFU Status.

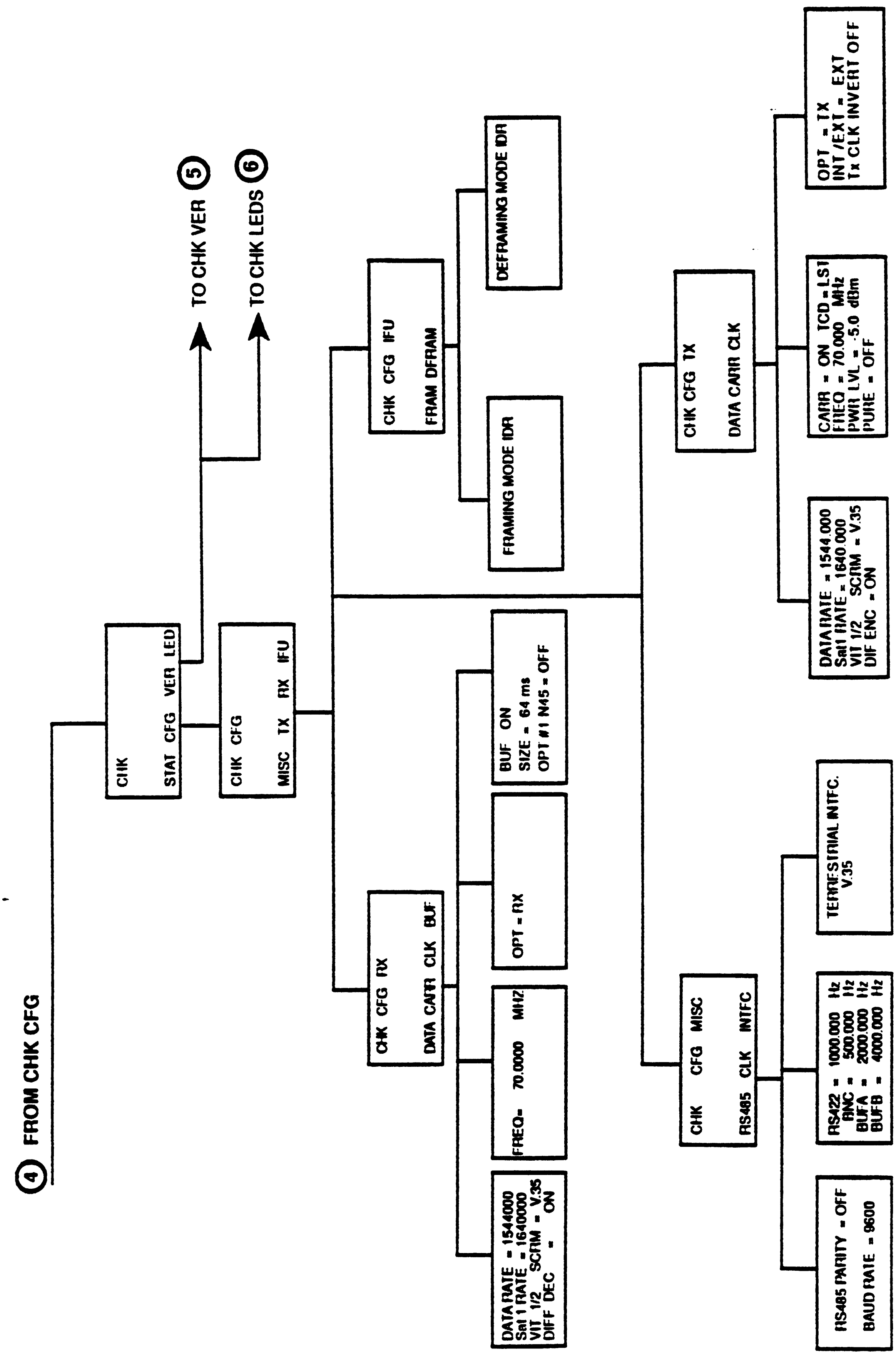


Figure 3-7. Checking Configuration.

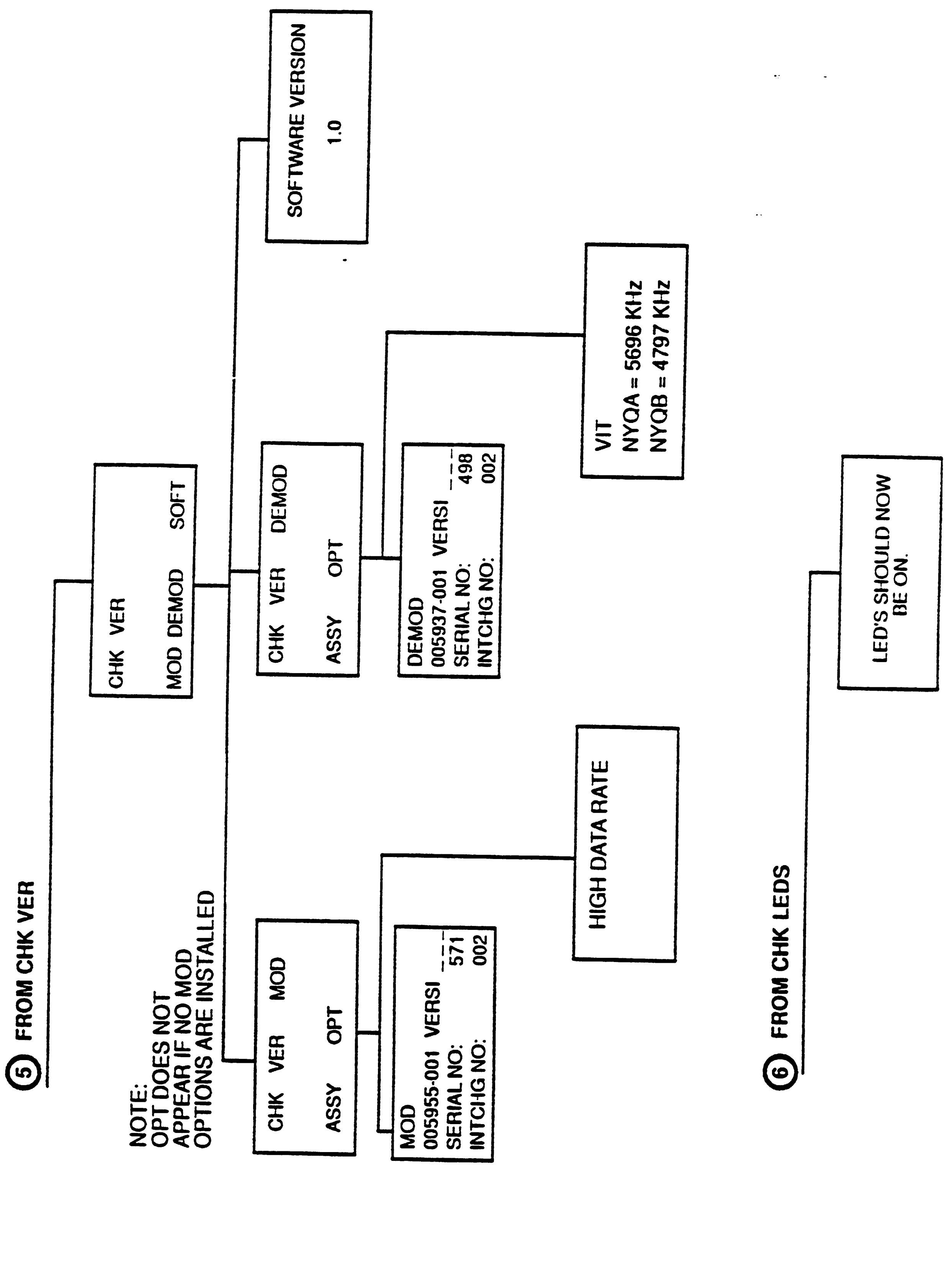


Figure 3-8. Checking Software Version and LEDs.

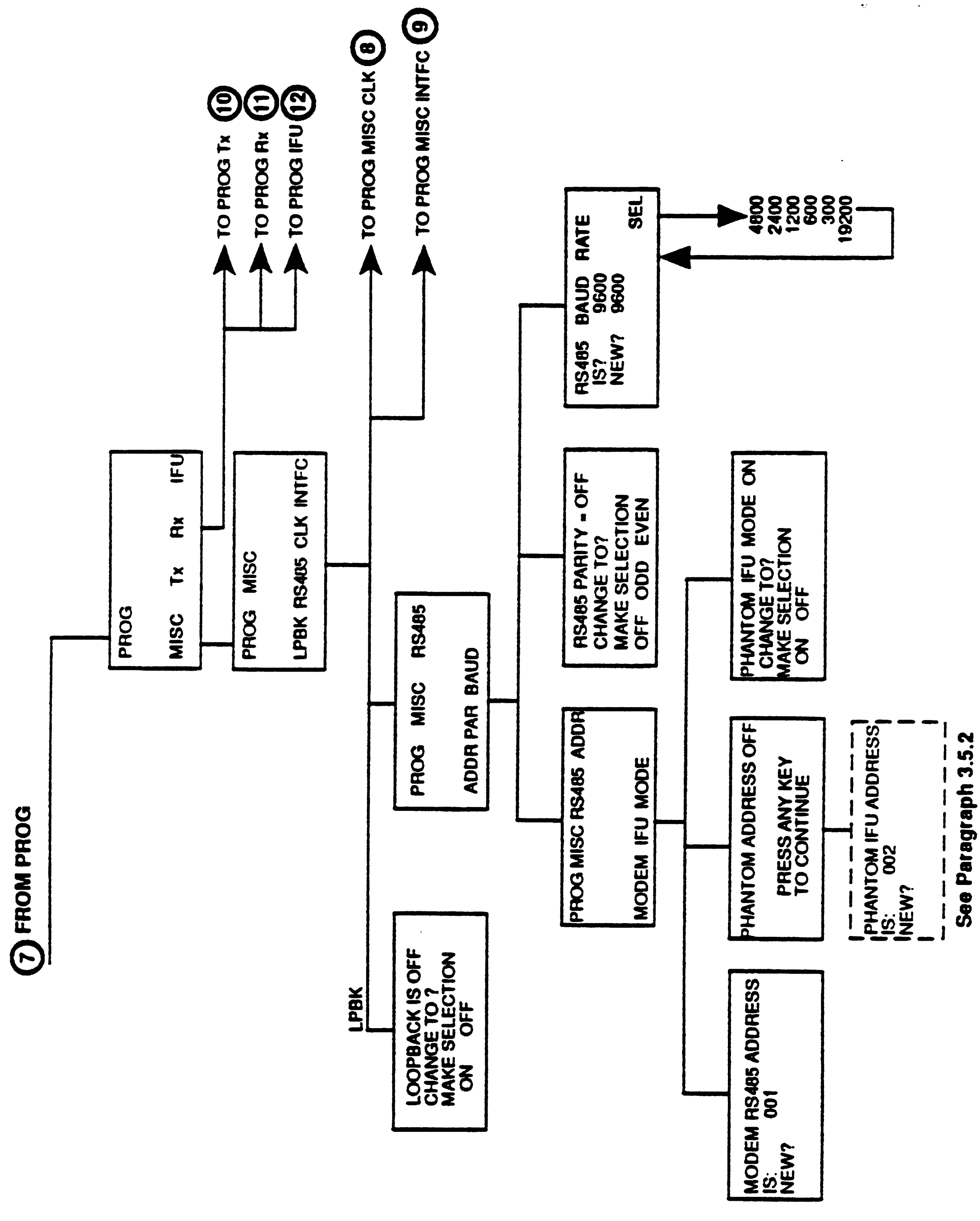
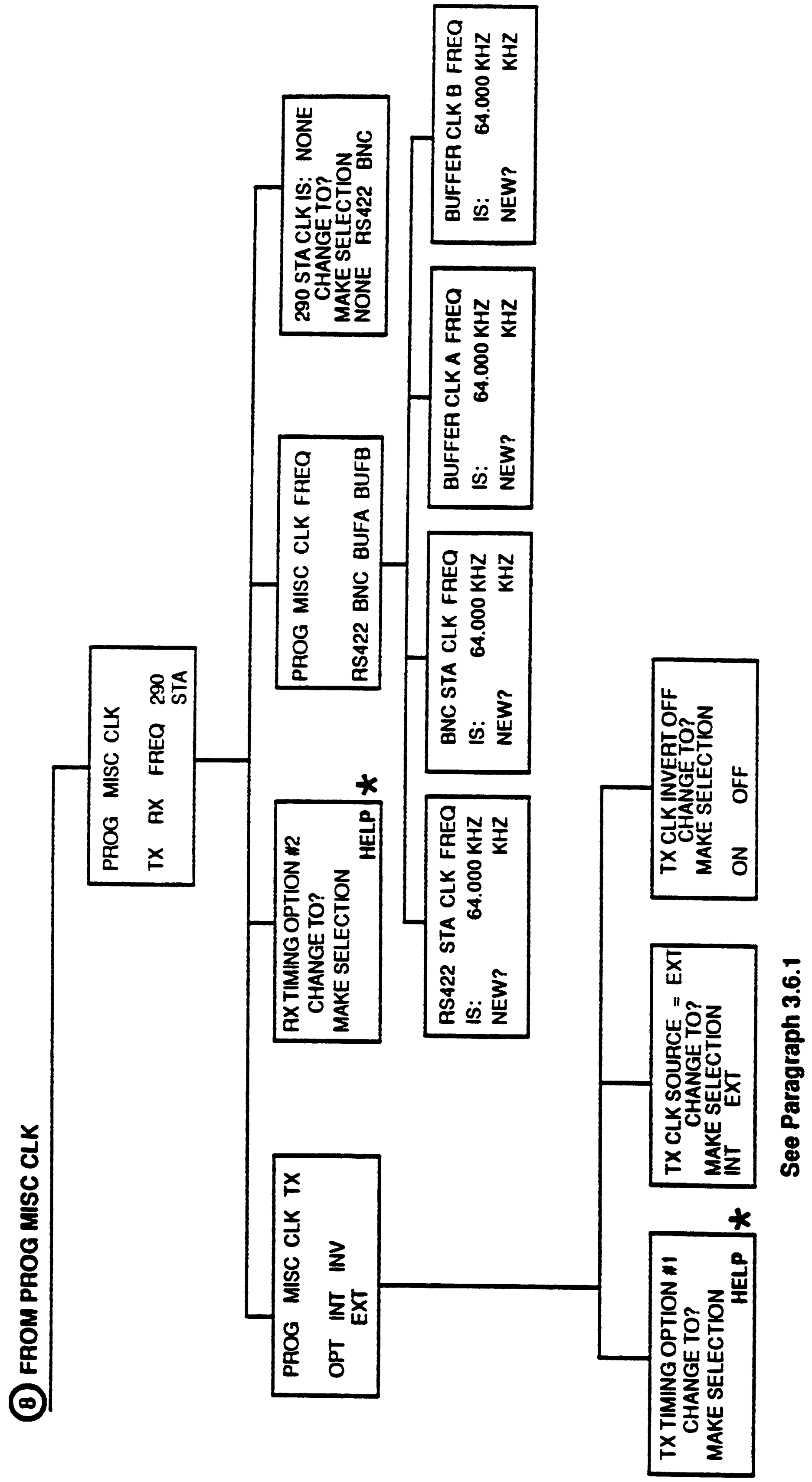


Figure 3-9. Programming Miscellaneous, Loopack, RS485.



*HELP MENUS. A summary of clock options is provided in HELP menu. Refer to Section 3 for further descriptions.

Figure 3-10. Programming Miscellaneous Clocks.

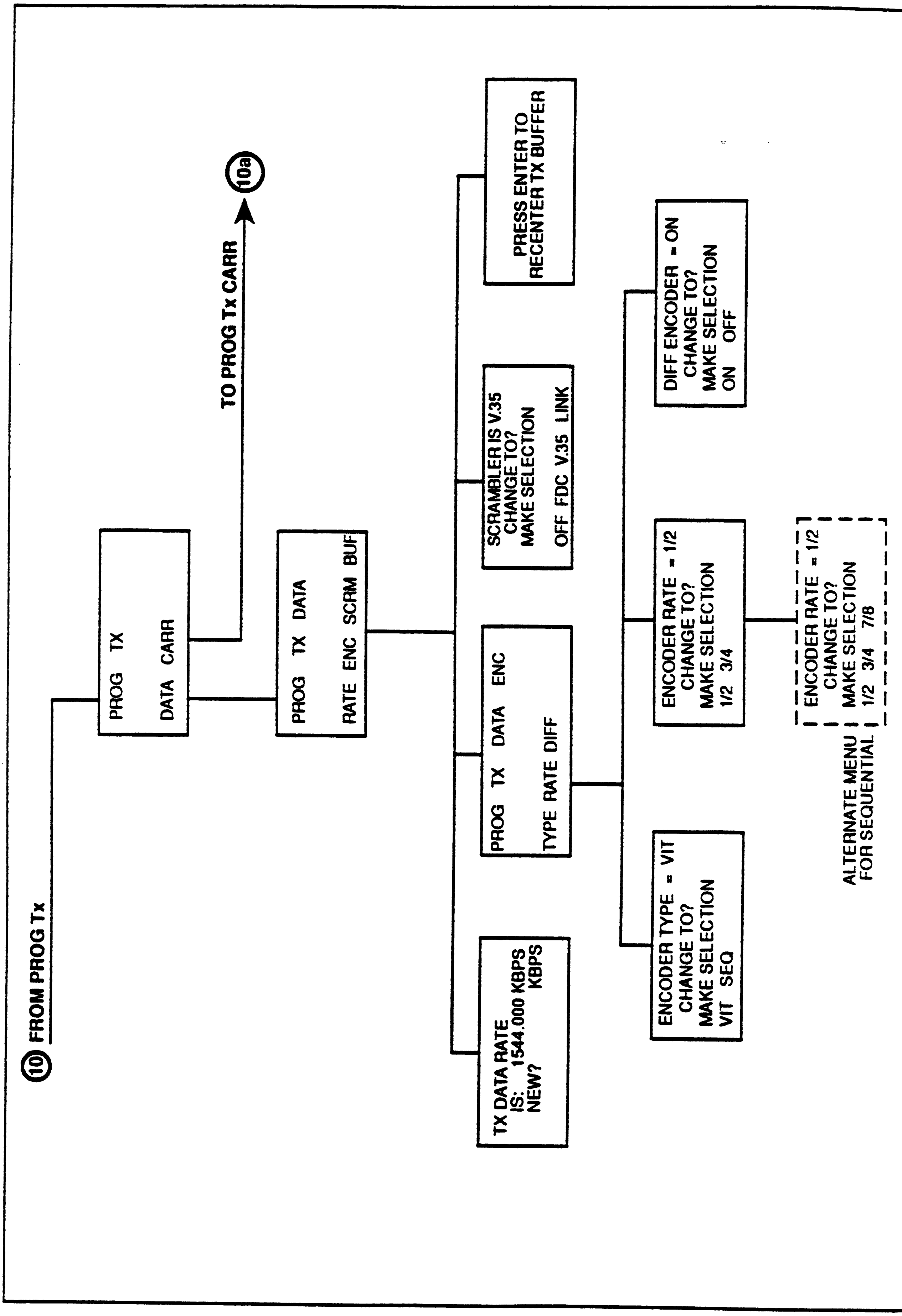
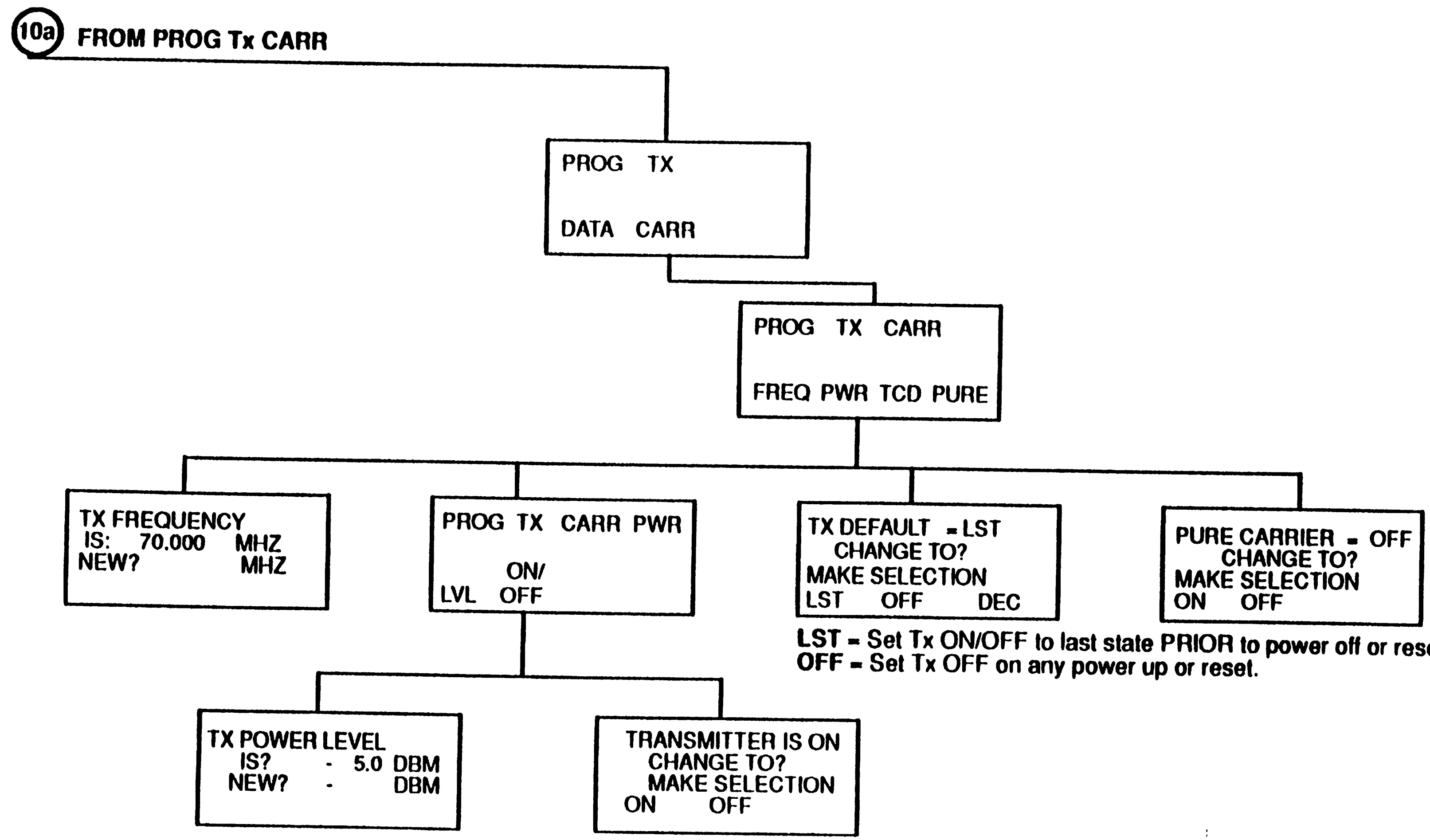


Figure 3-12. Programming Transmit Data.



LST = Set Tx ON/OFF to last state PRIOR to power off or reset.
OFF = Set Tx OFF on any power up or reset.

Figure 3-13. Programming Transmit Carrier.

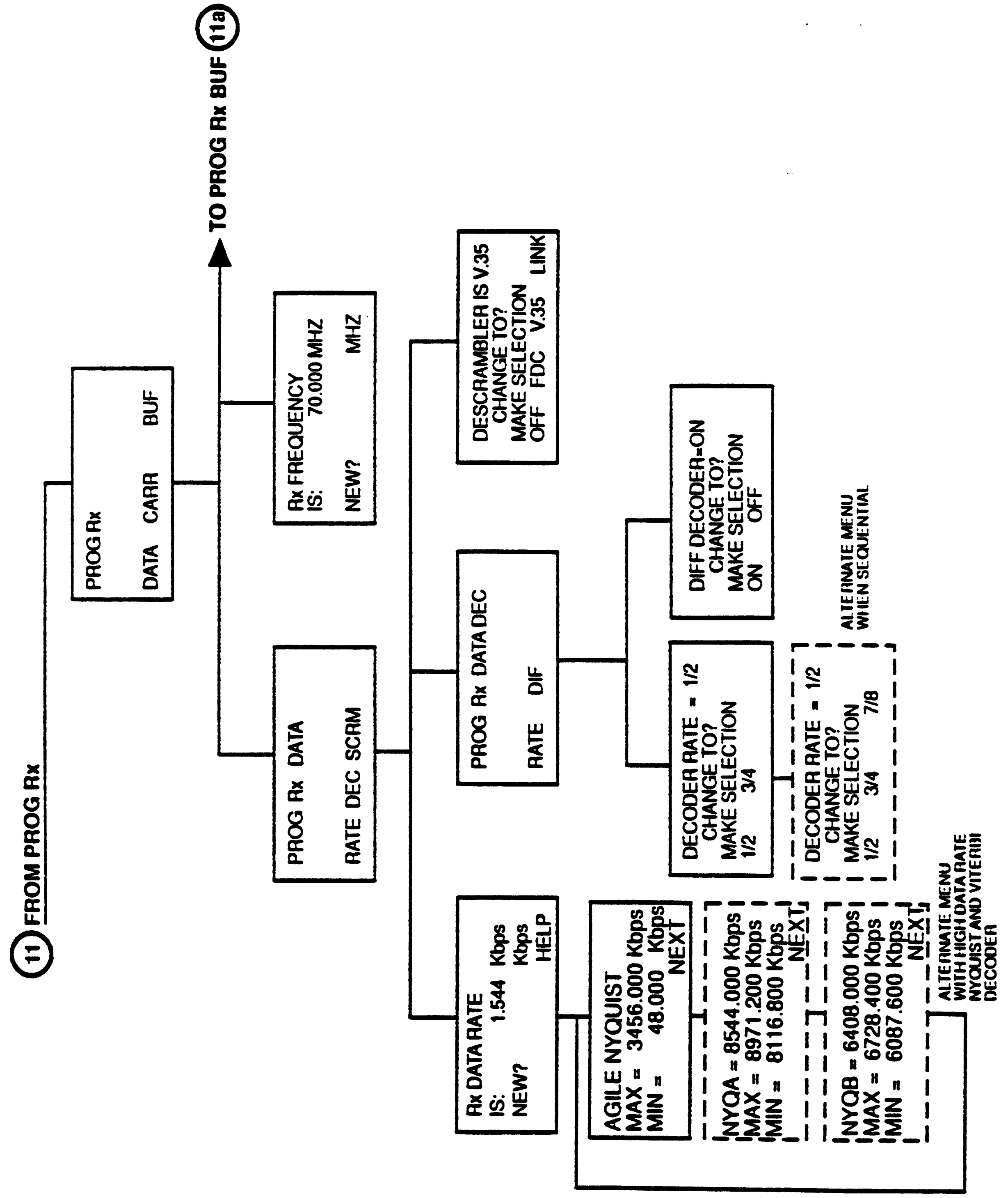


Figure 3-14. Programming Receive Data.

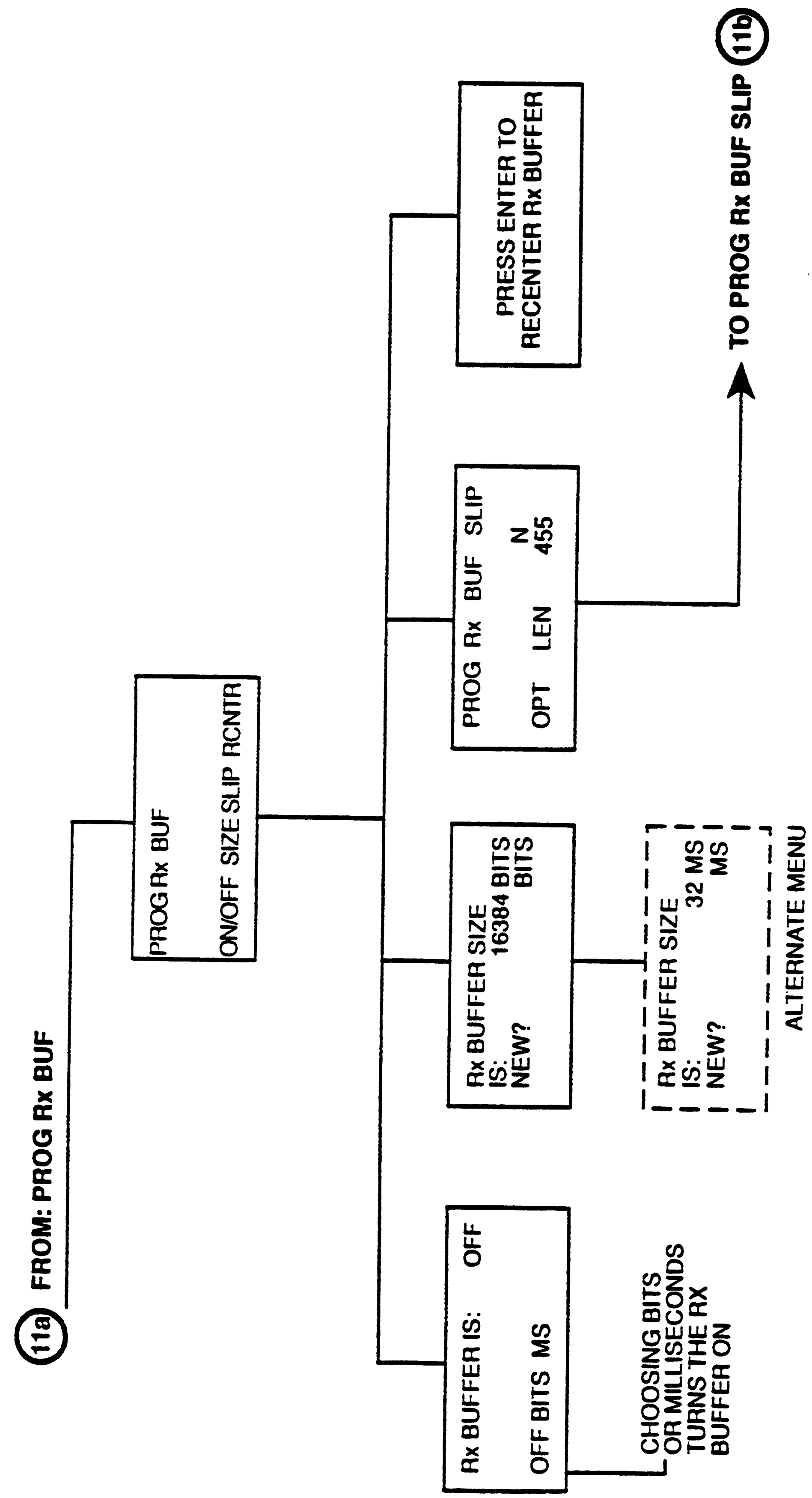
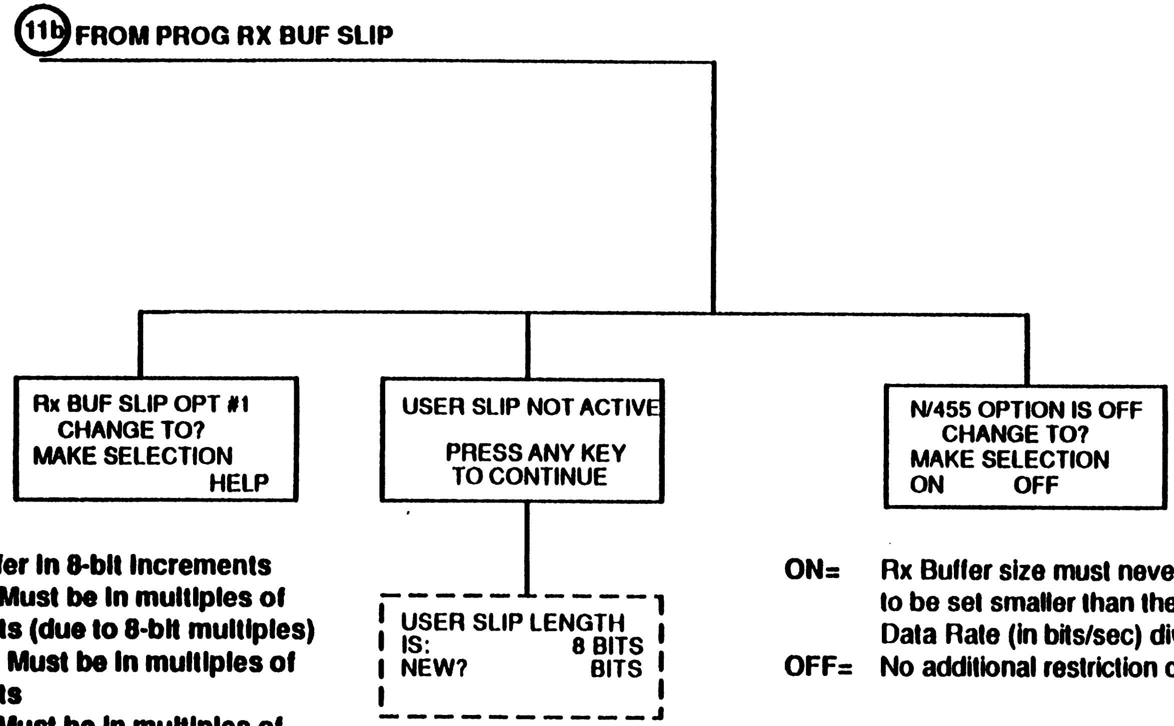


Figure 3-15. Programming Receive Buffer.



Option 1	Rx Buffer in 8-bit increments
Option 2	T1-D4 Must be in multiples of 4632 bits (due to 8-bit multiples)
Option 3	T1-ESF Must be in multiples of 4632 bits
Option 4	G.732 Must be in multiples of 4096 bits
Option 5	Must be in multiples of 1196 bits
Option 6	Must be in multiples of 840bits
Option 7	Must be in multiples of 848 bits
Option 8	Multiples of User Slip Length

*ALTERNATE MENU
This menu active when
Option 8 is chosen
(Must be in multiples of 8 bits)

ON=	Rx Buffer size must never be allowed to be set smaller than the value in bits of Data Rate (in bits/sec) divided by 455.
OFF=	No additional restriction on buffer size

HELP Menus: A summary of Rx Buffer options is provided in the HELP menu. Refer to Section 3.9 for further description.

Figure 3-16. Programming Receive Buffer Slip.

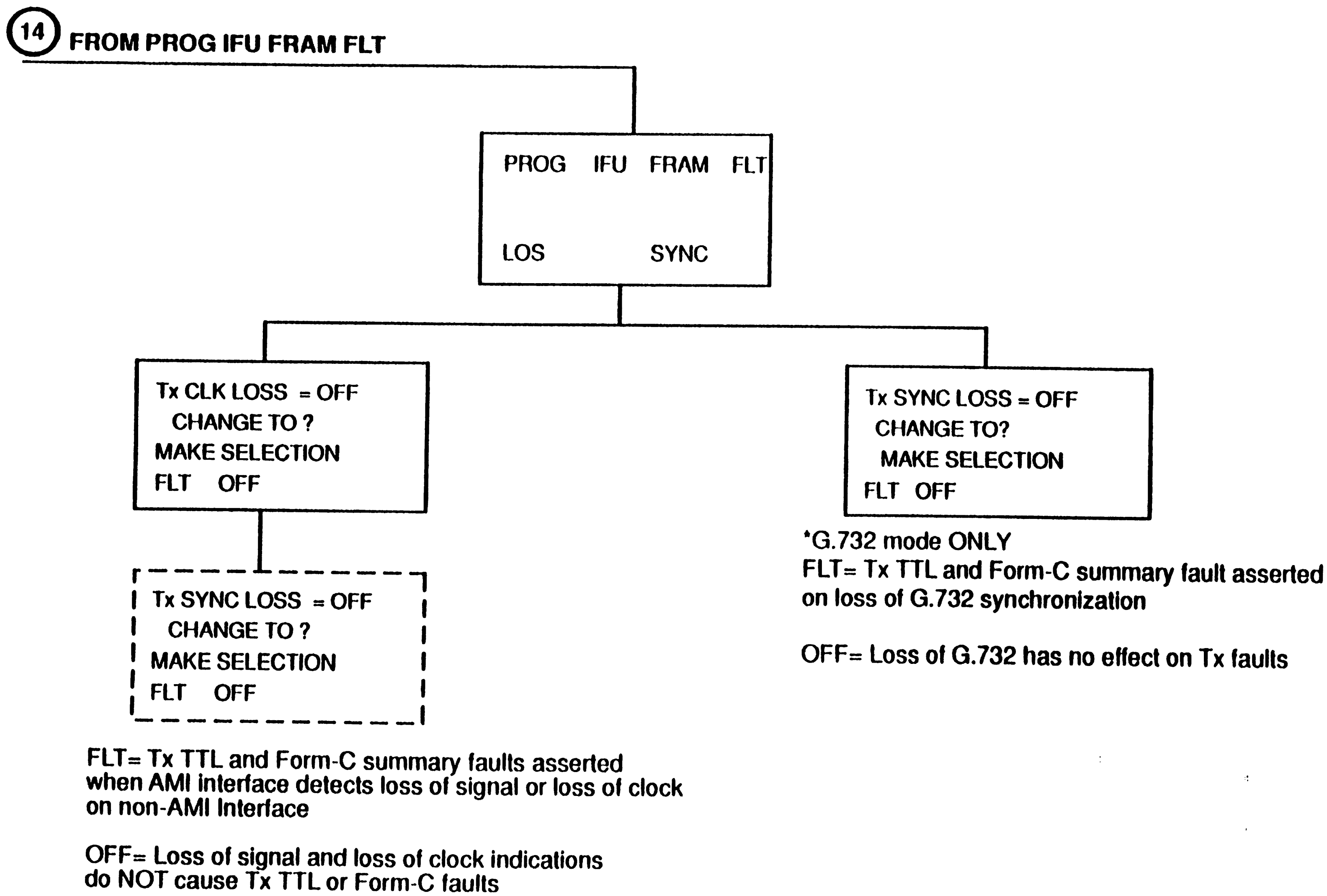


Figure 3-19. Programming IFU Framing FLT

(15) **FROM PROG IFU DFRAM AIS**

Rx BER ALARM = OFF
CHANGE TO ?
MAKE SELECTION
AIS OFF

AIS= All 1's asserted when deframer registers a 1 - 10^{-3} BER Alarm

OFF= Take no action on the data due to BER alarm

(16) **FROM PROG IFU DFRAM FLT**

Rx BER ALARM = OFF
CHANGE TO ?
MAKE SELECTION
FLT OFF

FLT= Rx TTL and Form-C summary asserted when deframer registers a 1 - 10^{-3} BER Alarm

OFF= Deframe BER ALARM NOT part of Rx fault summary

Figure 3-20. Programming IFU DFRAM AIS and FLT

OPERATING CHARACTERISTICS

Communication Modes	Full-duplex or simplex; independent transmit and receive
Modulation	QPSK
Compatibility	IESS 308, 309, BS7-40E (Viterbi) SM2900/SM290/SM240/SM220/SM200 (Sequential)
Carrier Spacing	1.4 times the Symbol Rate, except 55 KHz, minimum
Program Control	Via RS-485 (remote) or front panel keypad (local)

Data Rate and Code Rate (Unframed)

MODULATOR
Programmable with one bit/second resolution over the following ranges:

Decoding Type	Code Rate	Data Rate (Kbps)
Viterbi (K=7)	1/2	32 to 6312
Viterbi (K=7)	3/4	48 to 8448
Sequential	1/2	32 to 2304
Sequential	3/4	48 to 2304
Sequential	7/8	56 to 2304

DEMODULATOR
Programmable with one bit/second resolution over the following ranges:

Decoding Type	Code Rate	Data Rate (Kbps)
Viterbi (K=7)	1/2	32 to 2304
Viterbi (K=7)	3/4	48 to 3456
Sequential	1/2	32 to 2304
Sequential	3/4	48 to 2304
Sequential	7/8	56 to 2304

HIGH DATA RATE DEMOD DATA FILTER
User specifies two symbol rates that may be programmed for the demod over the following ranges:

Decoding Type	Code Rate	Data Rate (Kbps)
Viterbi (K=7)	1/2	2305 to 6312
Viterbi (K=7)	3/4	3089 to 8448

INTERNAL FRAMING UNIT (IFU) /ESC

IDR Data Rates	1544, 2048, 6312, and 8448 Kbps per IESS-308 (Rev. 6) 512 Kbps withIBS overhead per IESS-308 (Rev. 6). Coding per IESS-308 is rate 3/4 only but is usable with K=7 rate 1/2 or 3/4 coding or sequential rate 1/2, 3/4, or 7/8 coding
IBS Data Rates	n x 64, up to 2048 Kbps per IESS-309 (Rev. 3). Coding per IESS-309 is rate 1/2 only but usable with K=7 rate 1/2 or 3/4 coding or sequential rate 1/2, 3/4, or 7/8 coding
Framing Overhead	
IDR	Data rate plus 96 Kbps, except 512 Kbps, which uses IBS OH
IBS	16/15 times data rate per IESS-309 (Rev. 3) except for 1544 Kbps & G.732 1544 Kbps per IESS-309 (Rev. 3).
Bypass	Pass data to and from the modem without framing

ambling	IESS 308 (V.35) Fairchild or Linkabit Compatible
ring	9-Pole Nyquist, compatible with IESS 308, 309
put Impedance	75 Ohms
put Return Loss	20 dB min. (50-90 MHz); 18 dB min. (100-180 MHz)

DEMODULATOR/DECODER

it Power Range	-35 to -55 dBm
it Frequency	50-90 MHz or 100-180 MHz
uisition Range	±25 KHz (Min.) from nominal input frequency
imum Composite Input Level	30 dB greater than desired carrier
t Impedance	75 Ohms
t Return Loss	20 dB Min. (50-90 MHz); 18 dB Min. (100-180 MHz).
crambling	IESS 308 (V.35) Fairchild or Linkabit compatible
ier Level Reporting	-30 to -60 dBm, 0.25 dB steps, ±3 dB accuracy
ier Frequency Reporting	100 Hz resolution, 3 ppm reference

ER performance is in the presence of two like-modulated carriers spaced at 1.4 times the symbol rate each 14 dB r in power. Total interfering power in the range of 98-102 MHz must be no more than 7dB greater than the desired l.

SEQUENTIAL (With V.35 Scrambler)

ta Rate (Kbps)	Maximum BER	Eb/No (dB) R=7/8	Eb/No (dB) R=3/4	Eb/No (dB) R=1/2
56	10^{-5}	6.9	5.8	4.9
	10^{-6}	7.6	6.3	5.4
	10^{-7}	8.3	6.7	5.8
1544	10^{-5}	7.2	6.4	5.9
	10^{-6}	7.8	6.9	6.3
	10^{-7}	8.3	7.3	6.7
2048	10^{-5}	7.3	6.6	6.2
	10^{-6}	7.8	7.1	6.6
	10^{-7}	8.3	7.6	7.0

VITERBI

	Maximum BER	Eb/No (dB) R=3/4 V.35 Scrambler	Eb/No (dB) R=1/2 No Scrambler
All Data Rates	10^{-3}	5.3	4.2
	10^{-4}	6.1	4.7
	10^{-5}	6.9	5.4
	10^{-6}	7.6	6.1
	10^{-7}	8.3	6.7
	10^{-8}	8.8	7.2

ACQUISITION DESCRIPTION

M2900 PLUS will acquire carriers with up to 25 KHz offset from the programmed receive frequency. The demodulator r recovery sweeps one acquisition window that is slightly more than 50 KHz wide and is centered on the programmed e frequency. The sweep is from the upper side of the window to the lower side. After acquisition, the demodulator the carrier, and if the carrier is lost for two seconds, the acquisition sweep is resumed from the point where the carrier ost. The time required for carrier acquisition is a function of the offset of the acquisition sweep from the carrier at the hat the carrier is applied to the demodulator. The time required for one complete acquisition sweep is:

$$F_s < 64 \longrightarrow T = \frac{1280}{F_s} + 20$$

$$64 \leq F_s < 128,\ T = \frac{2944}{F_s} + 5$$

$$F_s \geq T = 128\ \frac{2944}{F_s}$$

Where: F_s = Symbol Rate in KHz
T= Sweep Time in seconds

The recommended switch settings for the SM2800 / SM2900 modems are:

SM2800	SM2900	DESCRIPTION
RD IS RD	RD IS RD	RD is decoder data
CTS IS RTS	CTS IS RTS	CTS is asserted when
RSLD NORM	1/ RSLD INV	Sets the proper polarity
10 BITS	10 BITS	10 bits per Character

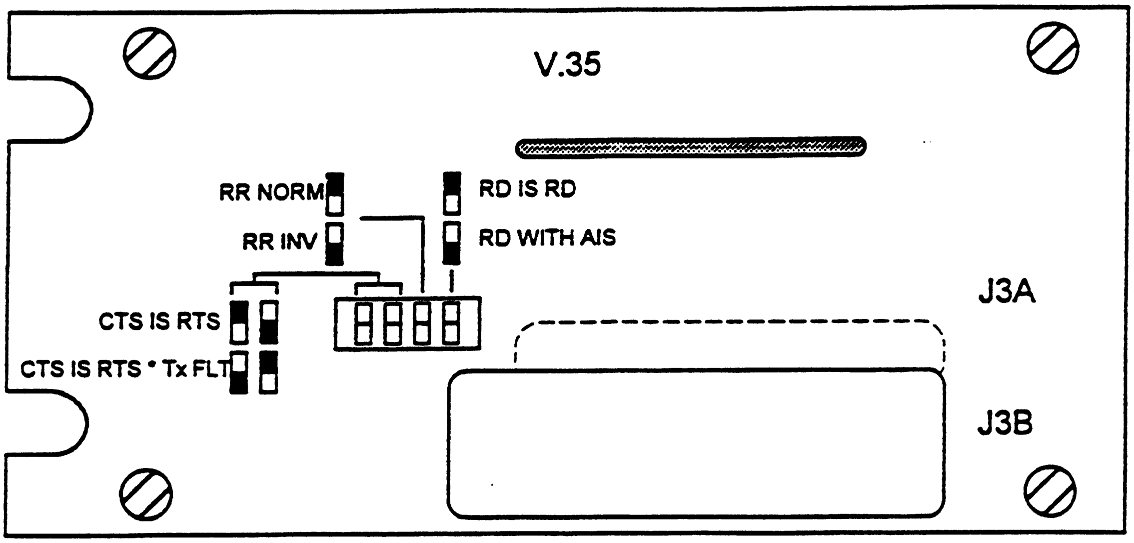
1/ SM2900: To activate this function set TP2 on the Demodulator to LCK M&C. Normally, the SM2900 is delivered with TP2 set to the INH (inhibit) position which forces RR ON. For further information on TP2 refer to the manual.

Figure 1 shows a diagram of the switches for setting the interface selections as viewed from the rear of the modem.

3.2 Connector Pinout

The pinout for the interface is shown in **Table 1**.

V.35 Interface



DOTTED LINE INDICATES LOCATION OF OPTIONAL 25 PIN D CONNECTOR

Default Switch Settings:

The usual switch settings for the interface are shown below, as viewed from the rear of the modem:

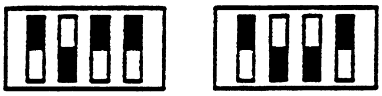


Figure 1. Switch Settings for the V.35 Interface

★ RS232 Sync / Async

RS232 Synchronous / Asynchronous Interface With Signaling

1.0 INTRODUCTION

The RS232 interface supports both synchronous / asynchronous data operation and is available with a 25 pin D Female connector. This data interface is also compatible with CCITT V.24 and V.28 interfaces including an ISO IS2110 type connector. The interface has user selectable features permitting operation from either a synchronous data interface or from an asynchronous port such as those commonly found on a PC or other serial (RS232) devices. This interface is usable from 0 to 84 Kbps depending upon user selections.

2.0 Interface With Signaling Capabilities

RS232 Sync / Async	
Interfaces Provided	RS232, V.24 / V.28
Connector Type	25 Pin D, Female
Signals supported	Data: BA (103), BB (104) Clock: DA (113), DB (114), DD (115) Control: CC (107), CA (105), CB (106), CF (109)
Modes Of Operation	<u>Synchronous</u>: Interfaces to a synchronous RS232 port. Asymmetrical Tx and Rx data rates OK. <u>Pseudo Asynchronous</u>: Interfaces to a standard asynchronous RS232 port. Modem data rate is set to approximately 4 x baud rate of DTE (4 x oversampling). Asymmetrical Tx and Rx data rates OK. <u>Asynchronous</u>: Interfaces to a standard RS232 port of a PC or other serial device. Supports 8, 9, 10 or 11 bit character length. Symmetrical data rates only, the Tx and Rx data rates are the same which is standard for virtually all RS232 serial ports.
Data Rates	The modem and interface data rates must match. The RS232 interface supports the rates below: **Synchronous:** 3.1 to 84 Kbps **Pseudo Asynchronous:** 0 to 28 Kbps, at 4 x oversampling **Asynchronous:** 3.1 to 84 Kbps
Modem Firmware Ver	SM2800 Ver 2.0 or higher SM2900 Ver 2.xx, 5.xx or higher

Table 1. RS232 DATA INTERFACE WITH SIGNALING

RS232, (25 PIN - D - F)		V.24 / V.28 (25 PIN - D - F)		TYPE	IN / OUT REL TO DCE	DESCRIPTION
PIN	NAME	PIN	NAME			
2	BA	2	103	DATA	IN	Send Data A or Tx Data A
				DATA	IN	Send Data B or Tx Data B
3	BB	3	104	DATA	OUT	Receive Data A or Rx Data A
				DATA	OUT	Receive Data B or Rx Data B
24	DA	24	113	CLOCK	IN	Terminal Timing A or Tx Signal Timing Element (DTE) A
				CLOCK	IN	Terminal Timing B or Tx Signal Timing Element (DTE) B
15	DB	15	114	CLOCK	OUT	Send Timing A or Tx Signal Timing (DCE) A
				CLOCK	OUT	Send Timing B or Tx Signal Timing (DCE) B
17	DD	17	115	CLOCK	OUT	Receive Timing A
				CLOCK	OUT	Receive Timing B
6	CC	6	107	CONTROL	OUT	Data Set Ready A, Data Mode A or DCE Ready A
				CONTROL	OUT	Data Set Ready B, Data Mode B or DCE Ready B
4	CA	4	105	CONTROL	IN	Request To Send A
				CONTROL	IN	Request To Send B
5	CB	5	106	CONTROL	OUT	Clear To Send A
				CONTROL	OUT	Clear To Send B
8	CF	8	109	CONTROL	OUT	Receiver Ready A or Rx Line Signal Detector A
				CONTROL	OUT	Receiver Ready B or Rx Line Signal Detector B
	-		-	CONTROL	OUT	Transmit Fault, TTL OC
	-		-	CONTROL	OUT	Receive Fault, TTL OC
1	Shld Gnd	1	Shld Gnd	GND	GND	Shield or Protective Ground
7	Sig Gnd	7	Sig Gnd	GND	GND	Signal or Return Ground

★ G.703 64 KBPS (Co-Directional)

G.703 64 Kbps Codirectional Interface

1.0 INTRODUCTION

The G.703 64 Kbps interface operates as a co-directional interface and supplies octet timing on the octet boundaries when used in IESS-309 applications. The octet timing may be either enabled or disabled. The interface is provided with both the common 25 pin female D connector and BNC type Twinax connectors.

2.0 Interface With Signaling Capabilities

G.703 64 Kbps	
Interface Type	G.703 64 Kbps Co-directional
Connector Type	BNC Twinax (Amphenal 31-235). 2 each, one Tx, one Rx. 25 Pin D, Female
Octet Timing	Locks to incoming Tx Octet violations, when provided. Delivers Rx Octet violations when used with internal framing unit IFU plug in card. *When used <u>without</u> an IFU card the Rx octet violations can be delivered but the "true" octet boundary is arbitrary.
Select Items	* Jumper for selecting Rx octet clock enable / disable.
Modem Firmware Ver	SM2800 Ver 1.03 or higher SM2900 Ver 1.3, 2.0, 4.1

Notes:
* The SM2800 does not currently support octet timing. Rx octet on arbitrary boundary only.

3.0 User Set Switches

The user selection for the G.703 64 Kbps interface enables / disables the octet timing violations on the Rx data side of the interface. This selection is intended only as a setup operation and the jumper is accessed by removing the module from the rear of the unit. **Figure 1** shows a diagram of the switches for setting the interface selections as viewed from the rear of the modem.

3.2 Connector Pinout

The pinout for the balanced G.703 interfaces with D connectors is shown in **Table 1**, and **Table 2** shows the pinout for the G.703 BNC and for the 64 Kbps interface the Twinax connectors are shown.

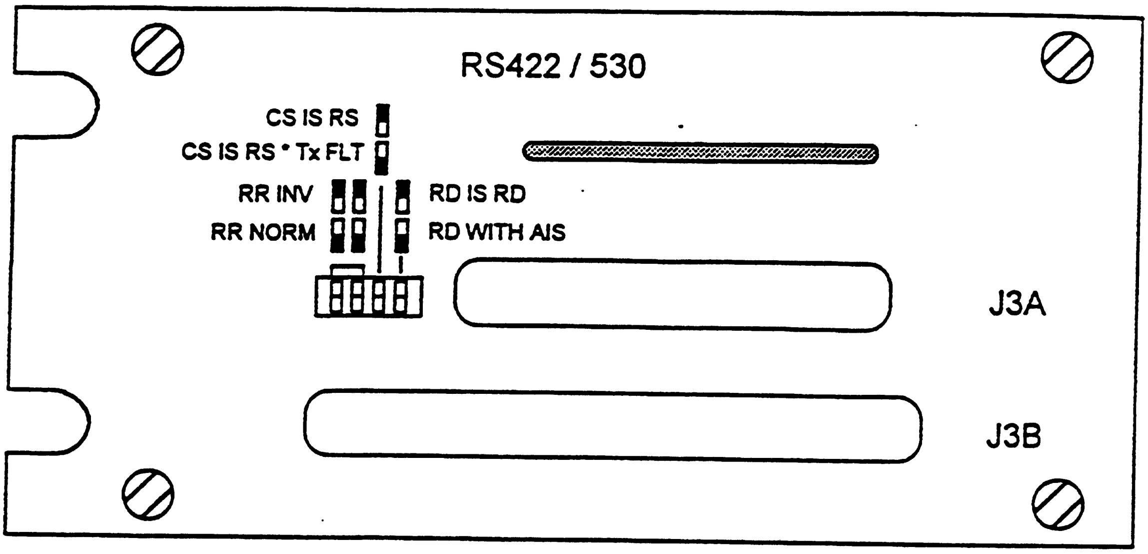
Table 1. G.703 D-Connector Interfaces

G.703 6312 / 8448 Kbps (15 PIN - D - F)		G.703 2048 Kbps (15 PIN - D - F)		G.703 1544 Kbps (15 PIN - D - F)		G.703 64 Kbps (25 PIN - D - F)				
PIN	NAME	PIN	NAME	PIN	NAME	PIN	NAME	TYPE	IN / OUT REL TO DCE	DESCRIPTION
1	SD-A	1	SD-A	1	SD-A	2	SD-A	DATA	IN	Send Data A or Tx Data A
9	SD+B	9	SD+B	9	SD+B	14	SD+B	DATA	IN	Send Data B or Tx Data B
3	RD-A	3	RD-A	3	RD-A	3	RD-A	DATA	OUT	Receive Data A or Rx Data A
11	RD+B	11	RD+B	11	RD+B	16	RD+B	DATA	OUT	Receive Data B or Rx Data B
14	Tx FLT	14	Tx FLT	14	Tx FLT	-	Tx FLT	CONT	OUT	Transmit Fault, TTL OC
15	Rx FLT	15	Rx FLT	15	Rx FLT	-	Rx FLT	CONT	OUT	Receive Fault,, TTL OC
2	Shld Gnd	2	Shld Gnd	2	Shld Gnd	1	Shld Gnd	GND	GND	Shield or Protective Ground
4	Sig Gnd	4	Sig Gnd	4	Sig Gnd	7	Sig Gnd	GND	GND	Signal or Return Ground

Table 2. G.703 BNC And TWINAX Interfaces

6312 / 8448 Kbps (BNC - F)		2048 Kbps (BNC - F)		1544 Kbps (BNC - F)		64 Kbps (Twinax)				
PIN	NAME	PIN	NAME	PIN	NAME	PIN	NAME	TYPE	IN / OUT REL TO DCE	DESCRIPTION
Center	SD-A	Center	SD-A	Center	SD-A	A	SD-A	DATA	IN	Send Data A or Tx Data A
Shell	GND	Shell	GND	Shell	GND	B	SD+B	DATA	IN	Send Data B or Tx Data B
Center	RD-A	Center	RD-A	Center	RD-A	A	RD-A	DATA	OUT	Receive Data A or Rx Data A
Shell	GND	Shell	GND	Shell	GND	B	RD+B	DATA	OUT	Receive Data B or Rx Data B

RS422 / 530 Interface



Default Switch Settings:

The usual switch settings for the interface are shown below, as viewed from the rear of the modem:

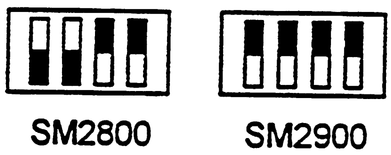
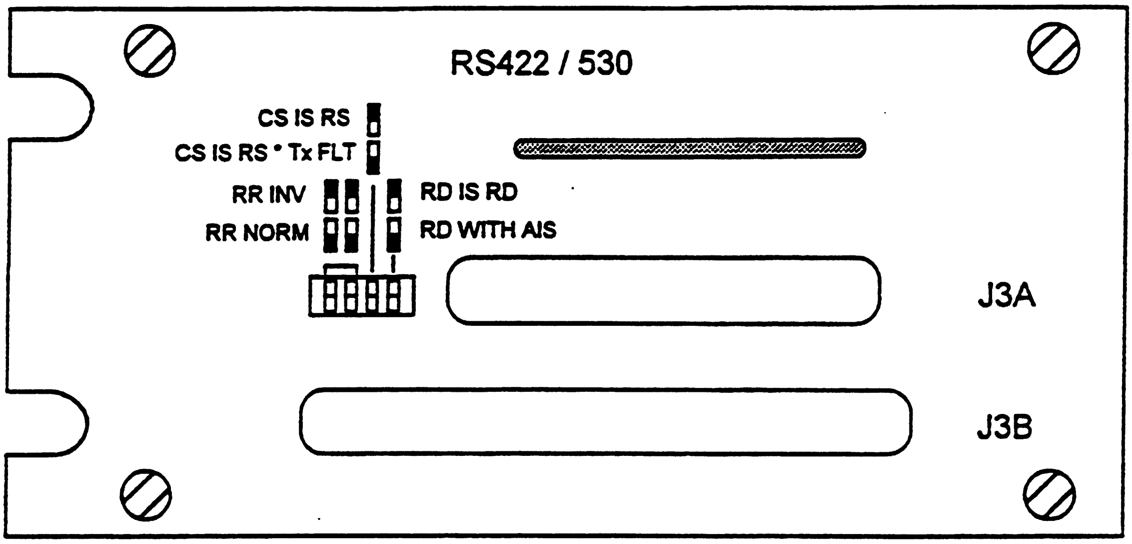


Figure 1. Switch Settings for the RS422 / 530 Interface

RS422 / 530 Interface



Default Switch Settings:

The usual switch settings for the interface are shown below, as viewed from the rear of the modem:

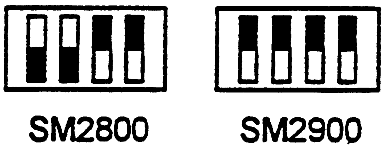


Figure 1. Switch Settings for the RS422 / 530 Interface

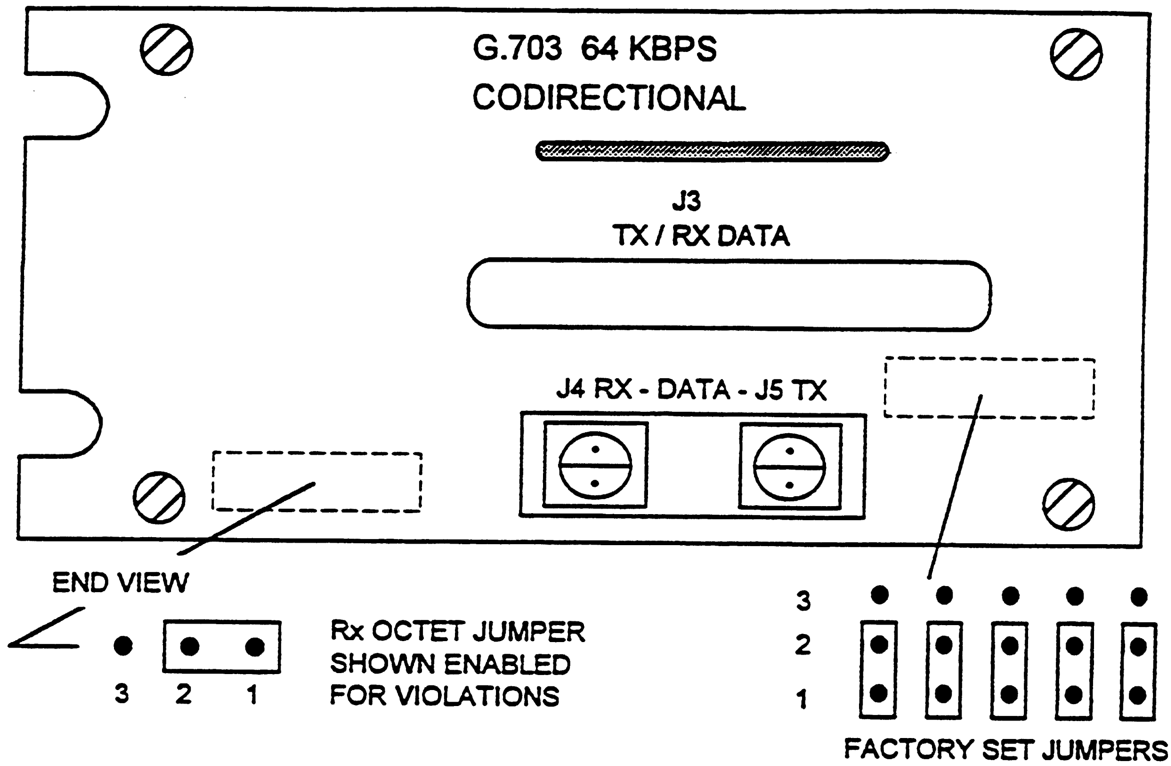


Figure 1. Switch Settings for the G.703 64 Kbps Codirectional Interface

2.1 Signal Conventions

The conventions for these signals are given below.

	TERMINAL VOLTAGE A	B	
1 = MARK = OFF	L	H	L = Low, H = High
0 = SPACE = ON	H	L	

The voltage level for each type of interface is in accordance with the applicable data interface standard.

Timing of the clock and data wave forms appears with the 0 to 1 transition of the clock at the midpoint of the data bit.

3.0 User Set Switches

3.1 Switch Selections For Interfaces with Signaling

Each interface has user set controls selectable by switches accessible from the rear of the modem. Below is a description of the controls followed by diagram summarizing the switch settings.

CTS Control: When set to CTS IS RTS then CTS is enabled (ON) approximately 8 ms after RTS is applied. The signal can be further qualified when the CTS control is set to CTS IS RTS•Tx FLT. Tx FLT (Transmit Fault) requires the Tx side of the modem to be unfaulted before CTS is asserted.

RD Control: Determines the state of RD (Rx Data) when the RR control line is OFF. In the RD IS RD position whatever data leaves the decoder (or framing unit if installed) is delivered to the Rx interface. This is the same way previous interfaces operated. When this control is set to the RD WITH AIS setting Rx Data = all 1s (AIS) whenever RR is OFF (decoder unlocked) and passes RD when RR is ON.

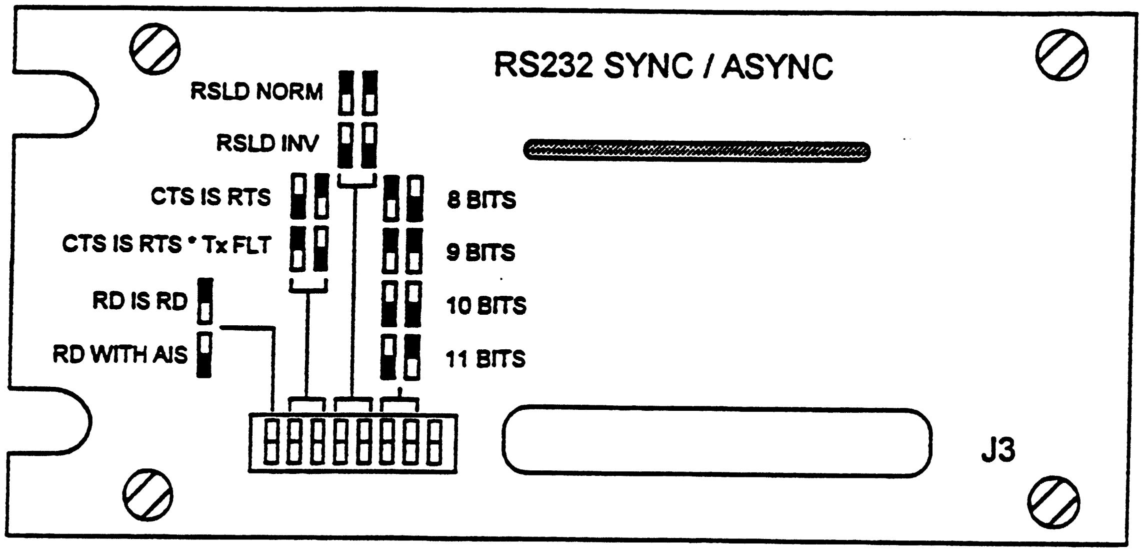
RR (RSLD) Polarity: This Control accommodates different versions of modems which have opposite polarities asserted for RR = ON. The selection either passes or inverts the RR signal generated in the modem so that the signal delivered to the interface now has the polarity defined by the interface specifications.

The RS232 interface has additional switches that select the NUMBER OF ASYNC BITs per asynchronous character. Settings are available from 8 to 11 bits including start and stop bits, parity, etc.; the use of the bits is arbitrary within these guidelines. Both ends of the link must have the same definition and the Tx data rate at BA must be the same number of bits and data rate as the Rx data rate at BB.

Table 1. V.35 DATA INTERFACE WITH SIGNALING

V.35 (WINCHESTER) 34 PIN - F		V.35 OPTIONAL (25 PIN - D - F)			IN / OUT REL TO	
PIN	NAME	PIN	NAME	TYPE	DCE	DESCRIPTION
P	SD-A	2	SD-A	DATA	IN	Send Data A or Tx Data A
S	SD+B	14	SD+B	DATA	IN	Send Data B or Tx Data B
R	RD-A	3	RD-A	DATA	OUT	Receive Data A or Rx Data A
T	RD+B	16	RD+B	DATA	OUT	Receive Data B or Rx Data B
U	SCTE-A	24	SCTE-A	CLOCK	IN	Terminal Timing A or Tx Signal Timing Element (DTE) A
W	SCTE+B	11	SCTE+B	CLOCK	IN	Terminal Timing B or Tx Signal Timing Element (DTE) B
Y	SCT-A	15	SCT-A	CLOCK	OUT	Send Timing A or Tx Signal Timing (DCE) A
AA	SCT+B	12	SCT+B	CLOCK	OUT	Send Timing B or Tx Signal Timing (DCE) B
V	SCR-A	17	SCR-A	CLOCK	OUT	Receive Timing A
X	SCR+B	9	SCR+B	CLOCK	OUT	Receive Timing B
E	DSR-A	6	DSR-A	CONTROL	OUT	Data Set Ready A, Data Mode A or DCE Ready A
				CONTROL	OUT	Data Set Ready B, Data Mode B or DCE Ready B
C	RTS-A	4	RTS-A	CONTROL	IN	Request To Send A
				CONTROL	IN	Request To Send B
D	CTS-A	5	CTS-A	CONTROL	OUT	Clear To Send A
				CONTROL	OUT	Clear To Send B
F	RLSD-A	8	RLSD-A	CONTROL	OUT	Receiver Ready A or Rx Line Signal Detector A
				CONTROL	OUT	Receiver Ready B or Rx Line Signal Detector B
MM	Tx FLT		-	CONTROL	OUT	Transmit Fault, TTL OC
NN	Rx FLT		-	CONTROL	OUT	Receive Fault, TTL OC
A	Shld Gnd	1	Shld Gnd	GND	GND	Shield or Protective Ground
B	Sig Gnd	7	Sig Gnd	GND	GND	Signal or Return Ground

RS232 Interface



Default Switch Settings:

The usual switch settings for the interface are shown below, as viewed from the rear of the modem:

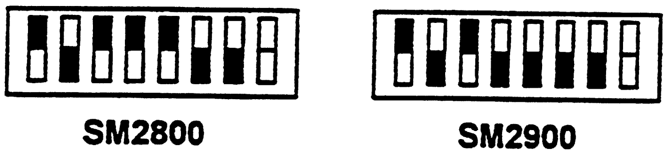


Figure 1. Switch Settings for the RS232 Interface

TERRESTRIAL DATA INTERFACES

Baseband	V.35, supporting CCITT circuits 101, 102, 103, 104, 113, 114, 115 RS422/RS449 G.703 T1 (1544 Kbps), BNC or 15-pin D G.703 E1 (2048 Kbps), BNC or 15-pin D G.703 T2 (6312 Kbps), BNC or 15-pin D G.703 E2 (8448 Kbps), BNC or 15-pin D
Line Codes	T1: AMI, B8ZS E1: AMI, HDB3 T2: AMI, B6ZS, HDB3, B8ZS E2: AMI, B6ZS, HDB3, B8ZS
Jitter	T1; Bell Pub. 41451 (Jan.1983) E1; CCITT Rec. G.823

MONITOR AND CONTROL

Bus Hierarchy	Master/Slave. Modems are Slaves. Up to 32 Slaves per Bus
Baud Rates	300, 600, 1200, 2400, 4800, 9600 and 19200 Baud
Protocol	Asynchronous, RS-485

CONTROL	STATUS
Transmit On/Off	Modulator Fault
Output Power	Demodulator Fault
Transmit Frequency	BER (Raw and Corrected), Eb/No
Receive Frequency	Summary Fault (Go/No Go)
Baseband Loopback	Buffer Status (Underflow/Overflow)
Data Rate (Tx/Rx)	Software Version
Code Rate and Type (Tx/Rx)	M&C/Interface Fault
Scrambler On/Off, Descrambler On/Off	Format Fault
Scrambler Type	Checksum Fault
Receive Buffer On/Off (Bypass)	Loss of Data Clock
Pure Carrier	Transmit Synthesizers Locked
Differential Encoder On/Off	Receiver Locked
Differential Decoder On/Off	Receive Synthesizer Locked
Transmit Carrier Default at Power-Up	Interface in Use
Rx Buffer Size	Backward Alarm(s)
Framing, IBS, IDR	Loss of Tx input clock or data
Clock Options	Loss of reference clock (when applicable)
Line Length	Loss of internal Tx clock
	Loss of Rx output clock
	Loss of frame sync
	Loss of multiframe sync
	BER > 10^{-9}

CHASSIS /POWER

Size	3.5" high x 19" wide x 22" deep
Weight	15 pounds
Power Supply	Auto-Ranging, 90 to 250 Vac at 47-63 Hz; -48 Vdc optional
Power Consumption	110 watts

ENVIRONMENTAL

Temperature	+10 to + 40° C Operating -25 to + 85° C Storage
Relative Humidity	5% to 95% Non-condensing
Altitude	10,000 Feet

Fairchild
Fairchild Data Corporation
350 N. Hayden Rd. • Scottsdale, AZ 85257-4692 • (602) 949-1155, or call 1-(800)-247-9489 • FAX: (602) 941-0023 • TWX: 910-950-0085

)C (IDR)	
ESC Data	One 8 Kbps full-duplex channel with octet Transmit data must be 8 KHz internal SCT Clock Electrical: RS422
Backward Alarm	4 alarms
Audio Channels	Audio - 2 full duplex channels. Balanced 600 Ohm, 4-wire, 300 to 3400 Hz Input Range -5 dBm ± 10 dB Output Range - 5 dBm ± 10 dB Audio Gain 0 dB
3C (IBS)	
Backward Alarm	Transmit - Via the M&C: Receive - Via M&C and Form-C relay contact closure; Open collector output.

CLOCK OPTIONS

: Clock	Normal or inverted
Reference Clocks	Tx & Rx independent Tx = Reference for Rx Rx = Reference for Tx (loop timing) Station Clock = Ref for Tx, Rx = independent = Ref for Rx, Tx = independent = Ref for both Tx and Rx
Station Clock	Tx and Rx data rates settable in: 1 bit/sec, STACLK = 0.032 - 4.096 Mbps 2 bit/sec, STACLK = 4.096 - 10.0 Mbps Inputs: RS422: Hi Z or 120 Ohms BNC: Hi z or 75 Ohms
Asymmetric Clocks	Tx or Rx are locked to each other, or Station Clock, in 1 or 2 bit/sec increments. ie: Tx = 64.000 and Rx = 200.001 Kbps is Ok with the Rx buffer enabled

RECEIVE BUFFERING

: Buffer Size	Bypass: buffer= 0 bits Buffer On: 80 min. to 128 Kbit, (131, 072) Max.
: Programming	Bits or milliseconds
uffer Slip	Frame boundaries

MODULATOR

utput Power	
Range	-5 to -25 dBm in 0.1 dB steps
Accuracy	±0.5 dB
Stability	±0.25 dB over time and temperature
utput Frequency	
Range	50-180 MHz
Step Size	2.5 KHz
Accuracy/Stability	1 ppm (over full operating temperature range)
Spurious Output	-55 dBc/4 KHz (maximum, carrier modulated) -40 dBc (maximum, carrier unmodulated)

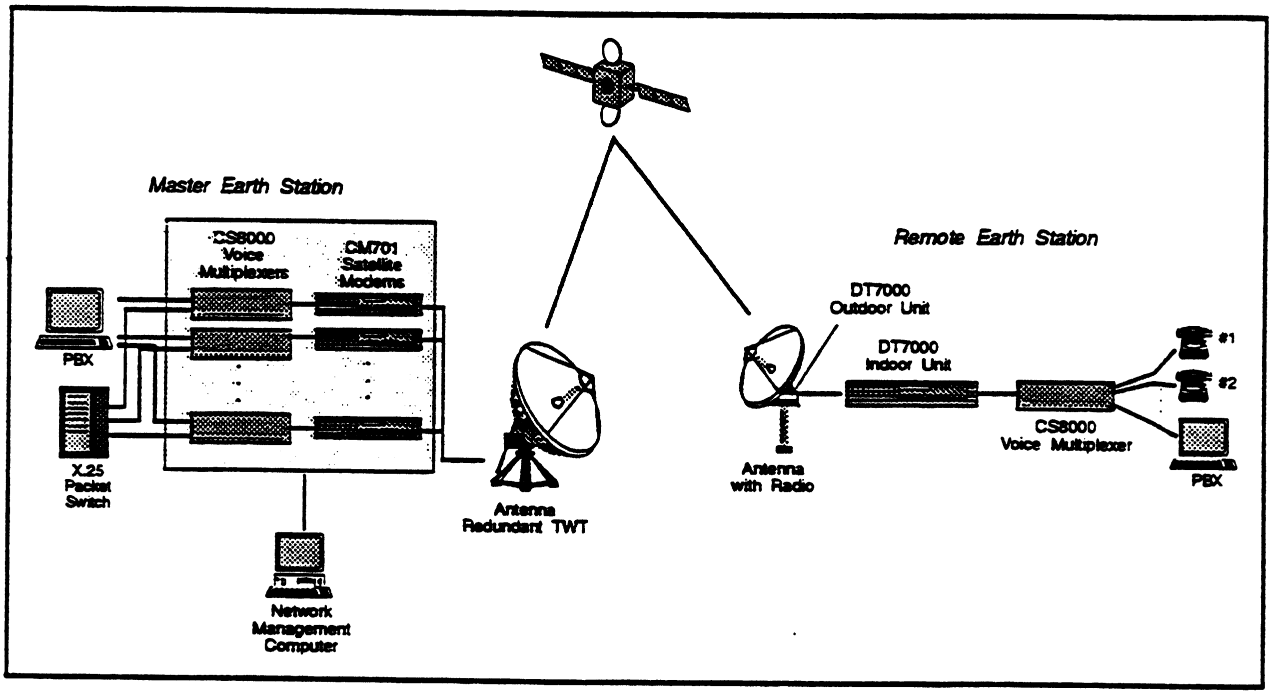
Chapter 1. CM701 Overview

The ComStream CM701 is a high performance PSK digital modem used in satellite communication applications requiring continuous transmission and continuous reception. The CM701 is extremely versatile, and continues the ComStream tradition of providing the very best modem performance in the industry. Better performance contributes directly to lower operating costs for satellite circuits.

The CM701 can be used to communicate with any other ComStream closed network modem, including both the CV and CM series of satellite modems, on a single-channel-per-carrier (SCPC) basis. As with all ComStream modems, the CM701 is compatible with the ComStream DT series of interactive earth stations, and the DBR series of clear channel digital broadcast receivers. Figure 1.1 shows an SCPC application using ComStream modems.

The CM701 can also be configured for open network applications, with the addition of the optional ComStream framing unit plug-in module. In this configuration, the CM701 is able to communicate with any other modem that complies with INTELSAT IDR and IBS open network specifications (IESS-308 and IESS-309), as well as the EUTELSAT SMS open network specification (BS 7-40).

Figure 1.1: SCPC Application Using CM701 Modems



The plug-in module mentioned previously is one of many that quickly and easily add new functions to the basic CM701 configuration. The CM701 is constructed using a modular architecture much like a personal computer. This construction allows each module to function independently, making the CM701 easy to customize for specific needs today, and easy to upgrade or expand to meet planned or unforeseen needs tomorrow. The modular architecture makes sparing simpler and less costly, in addition to making repairs easier to manage. In most cases, the CM701 eliminates the need to ship product back to the factory for configuration changes or repair, so long delays in transit or customs are eliminated as well.

Another advantage of using modular construction is the ability to deliver units very rapidly upon receipt of an order. This holds true for individual modules, which can be installed in CM701 in the field, as well as complete factory integrated units. This quick delivery reduces lead time and enables ComStream customers to manage their inventories better. Just-in-time custom modem configurations are now a reality.

The CM701 design is based on quality, flexibility, and value to the customer. Robust, reliable performance is largely attributable to ComStream application-specific integrated circuits (ASICs). These state-of-the-art digital components enable ComStream to dramatically reduce parts count, while at the same time decreasing variations in cost and production.

Additonal features of the CM701 ease the burden of system installation and maintenance. The CM701 supports many built-in diagnostic features aimed at detecting faults in both the internal circuitry, as well as in the external satellite communications link. Each CM701 module has an integrated microcontroller that performs built-in test algorithms to verify proper operation. The CM701 also contains an integrated bit error rate tester (BERT), which allows satellite link integrity testing through remote control commands or at the control front panel. These built-in features come standard with every CM701, and help reduce satellite circuit operating costs.

Every CM701 has an interactive control front panel with push buttons, LED indicators, and an LCD display. The control front panel is provided for local configuration, monitoring, and fault reporting of the CM701. There are no internal jumpers, straps, or switches requiring customer setup prior to operation. All configuration selections are made from the control front panel or by using a remote control terminal that easily connects to a port on the CM701 rear panel. Since there is no need to disassemble the unit, configuration is simpler, with less chance of damaging circuit cards or misplacing cables. For sensitive installations, the front panel can be disabled to prevent tampering by unauthorized personnel.

The CM701 variable rate modem specifications are proof positive how truly flexible and reconfigurable this unit is. There is virtually no need to specify any operating configuration parameters prior to a CM701 variable rate modem order, since it supports data rates from under 9.6 Kbps to 2.2 Mbps; BPSK and QPSK modulation; 100 Hz IF synthesizer resolution; code rates of 1/2, 3/4, 7/8, and uncoded; Viterbi and Sequential decoding algorithms; IBS, IDR, and SMS framing; a variety of digital filter shapes; and an auto-ranging 100 to 240 VAC switching power supply. Practically every satellite communication application can be supported with a standard CM701 configuration.

As with all ComStream modems, the CM701 can be used with ComStream protection switches to enhance circuit availability. The protection switch automatically replaces a failed primary modem with a spare. The CX101 switch offers 1-to-1 protection by providing a spare modem for each primary modem, while the CX801 switch offers 8-to-1 protection by providing a spare modem for up to eight primary modems.

Chapter 2. CM701 Functional Description

Chapter Overview

The ComStream CM701 responds to customer demand for two requirements in their satellite communication systems: 1) cost effectiveness, and 2) unique configurations. The first of these requirements must be achieved by efficient, high volume production of a stable cost-conscious design. The second requirement implies that each customer order must be customized to match a specific application. The CM701 architecture and design philosophy represent an optimal solution to these two opposing design goals.

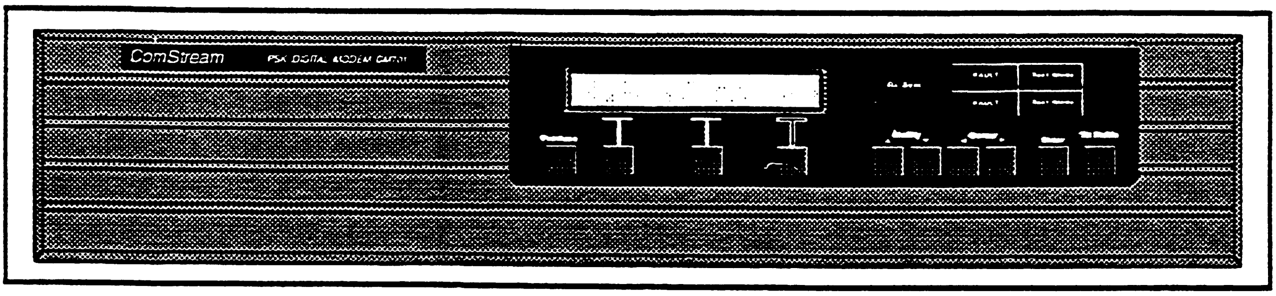
This chapter provides a summary of the features of the CM701, and a detailed explanation of its modular architecture. This modular architecture, complete with a number of custom integrated circuits, makes the CM701 cost-effective to manufacture, yet easy to customize to comply with special customer requests.

A Theory of Operation is also included, along with block diagrams and discussions of each significant module. The internal and external connections are summarized, and a brief overview of optional modules can be found near the end of the chapter.

CM701 Capabilities

As explained in the previous chapter, the CM701 is a digital PSK satellite modem, which serves as a link between the user's baseband data terminal equipment (DTE) and the IF frequency interface with a radio or up/downconverter. In addition to the basic PSK modem functions, the CM701 may be equipped with various option modules to provide data processing such as open network framing, doppler buffering, or data multiplexing.

Figure 2.1 CM701 Front View



As mentioned previously, the CM701 offers maximum flexibility in configuration that may be field selected by a user whose needs are unique, or vary over time. A summary of these flexible operating parameters is provided here:

- User data rates from 9.6 Kbps to 2.048 Mbps, 1 bps resolution
- Programmable Tx/Rx IF synthesizers, better than 100 Hz resolution
- BPSK and QPSK modulation
- Convolutional Encoder/Viterbi and Sequential decoders
- FEC code rates 1/2, 3/4, 7/8, as well as uncoded operation
- V.35 & IDR scrambler/descrambler
- Differential encoder/decoder, with support for QPSK uncoded operation
- Integrated monitor & control microcontrollers, remote and local control
- Complete digital processing, including IF synthesis and baseband filtering
- Data interface modules for RS-449,V.35,DS-1,G.703,RS-232, and more
- Built-in bit-error-rate-tester (BERT), operated locally or remotely
- Real time clock, with time-stamped fault reporting
- Extensive system loopback and built-in self-test capabilities
- Optional Open Network Framing Unit, complies with IBS,IDR,SMS stds.
- Exceptional BER versus Eb/No performance

In addition to these field configurable operating parameters, the CM701 has an auto-ranging AC power-supply that accommodates input voltages from 100 to 240 VAC at frequencies from 50 to 60 Hz. Two AC power cords are provided with each CM701, one for North American applications, and another for all international applications. Modulators and demodulators are factory configured for either 70±18 MHz IF or 140±36 MHz IF. The rear panel filler plate of each module is labeled with the IF frequency it supports. Each CM701 module is independent, thus a mix between 70 and 140 MHz modules in the same CM701 chassis is acceptable.

Local CM701 control is provided by the control front panel push buttons, LCD display, and LED indicators. Remote control is provided via a connector on the rear panel. A computer terminal is typically plugged into this connector, and is operated with a character oriented ASCII protocol and RS-232 electrical levels. Some applications require a computer to control many CM701 units on a single remote control bus. The CM701 remote control interface can be configured for RS-485 electrical levels, and packet-based protocol to accommodate this operating mode.

All CM701 configuration selections can be made using the control front panel user interface and/or the remote control command set. Every operating mode can be field selected by the user, with the single exception of the IF frequency range (70 versus 140 MHz), which must be factory configured.

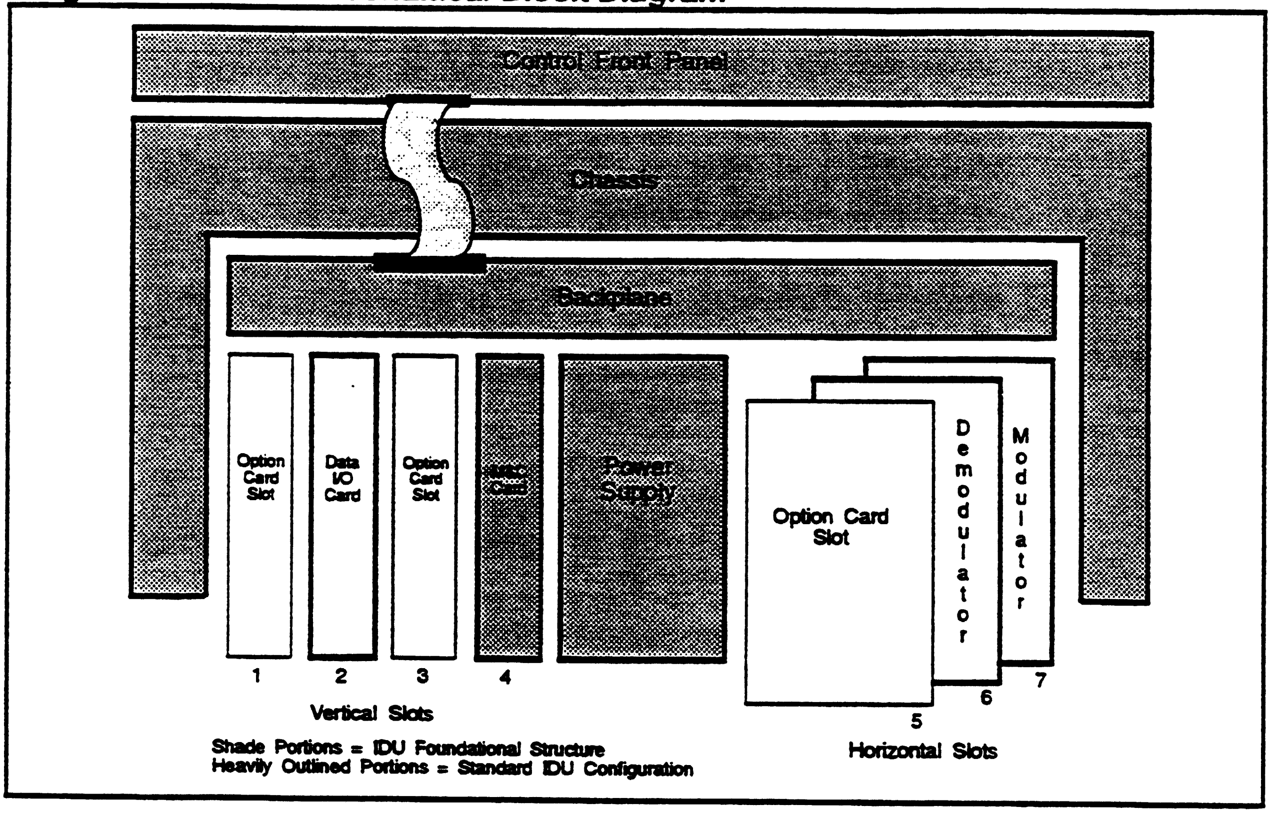
The CM701 is well suited for point-to-point satellite communications applications with data capacity requirements that change periodically. It can be reconfigured at any time for a different data rate, code rate, or modulation type. It is also valuable for users with many different communication requirements. One CM701 can be software configured for virtually any common operating mode. For applications requiring only one or a few configuration settings, lower cost single and quad rate versions of the modem are available, pre-configured from the factory. For high reliability applications, the CM701 provides exceptional MTBF performance, with its extensive digital processing and custom integrated circuits. The CM701 has been developed using the best commercial design practices, and complies with all applicable safety and emissions regulatory requirements worldwide.

CM701 Architecture

The CM701 is constructed as a number of independent modules housed in a 2U tall (3.5 inch), 19 inch rack-mount chassis. The modules are interconnected to each other, and to a master CM701 monitor & control module, by a simple backplane. The backplane provides interconnects for control, data, clock, frequency reference, and various other handshake signals between modules. Figure 2.2 shows a mechanical block diagram of the CM701, as if the top were removed and the modules were visible. As shown in the figure, there is only one interconnect cable inside the CM701 chassis. Minimizing cable interconnections improves reliability.

Although each of the modules are independent, there is a minimum subset of modules that must be present in every CM701, regardless of how the unit is customized to meet a particularly customer requirement. These modules are shaded in the figure, and consist of a Control Front Panel, Chassis, Backplane, Power Supply, and M&C Card. These modules constitute a "basic chassis assembly". Once this assembly is constructed, other modules are added to create a customer specific CM701. The additional modules that make-up a simple CM701 PSK modem are boldly outlined in the figure. These include a Data I/O Card, Demodulator, and Modulator.

Figure 2.2 CM701 Mechanical Block Diagram



The Data I/O Card may be RS-449, V.35, RS-232, DS-1, G.703, or any other electrical interface required by the user. The Demodulator and Modulator may support a 70±18 MHz IF frequency, or 140±36 MHz. These selections must be made by the user at the time of order, and are configured in the factory.

If an IF frequency or data interface requirement changes after a CM701 has been delivered (possibly even fielded by the user), a simple module swap (**in the field !**) can resolve the configuration mismatch. Modules purchased independent of complete CM701 units are called Field-Replaceable-Units (FRUs). FRUs can be ordered to simplify sparing, or to allow configuration changes without returning a CM701 to the factory. Virtually all CM701 modules described in this manual can be obtained as FRUs.

Beyond the "basic chassis assembly" and the "simple CM701 PSK modem" described above, many other option modules are available. As shown in Figure 2.2, the CM701 can accommodate up to three "option cards" in addition to the modules required to perform as a simple PSK modem. Some of these option modules have been described in previous paragraphs, and more are presented near the end of this chapter. ComStream can also develop new option modules in accordance with customer specifications.

The CM701 chassis is constructed similar to a personal computer chassis, consisting of a steel sheet-metal frame with a removable top cover of the same material, and an injection molded plastic front panel bezel. Within the chassis, each module contains an integrated microcontroller, nonvolatile memory, and unique control commands for configuration and status reporting.

Depending upon the particular communication application, a full complement of modules may not be required. For example, the CM701 can support transmit-only requirements with only a Modulator Card and an I/O Card. Similarly, receive-only operation is supported with only a Demodulator Card and an I/O Card.

Circuit card modules can be added, changed, or removed on-site in less than five minutes. If a different data interface is required, the old I/O Card can be removed and a new one containing the appropriate interface can be inserted into the same slot.

It is also possible for more than one of the same type of module to operate in a chassis at the same time. This is common when an interface on the transmit side is different than that on the receive side. For example, the data to be transmitted may be 2.048 Mbps with a G.703 balanced electrical interface, but the receive data may be only 9.6 Kbps on an RS-232 electrical interface. This requirement is easily supported by a CM701 containing both a balanced G.703 data I/O card and an RS-232 data I/O card, then using control front panel or remote control commands to designate which is the transmit I/O and which is the receive I/O .

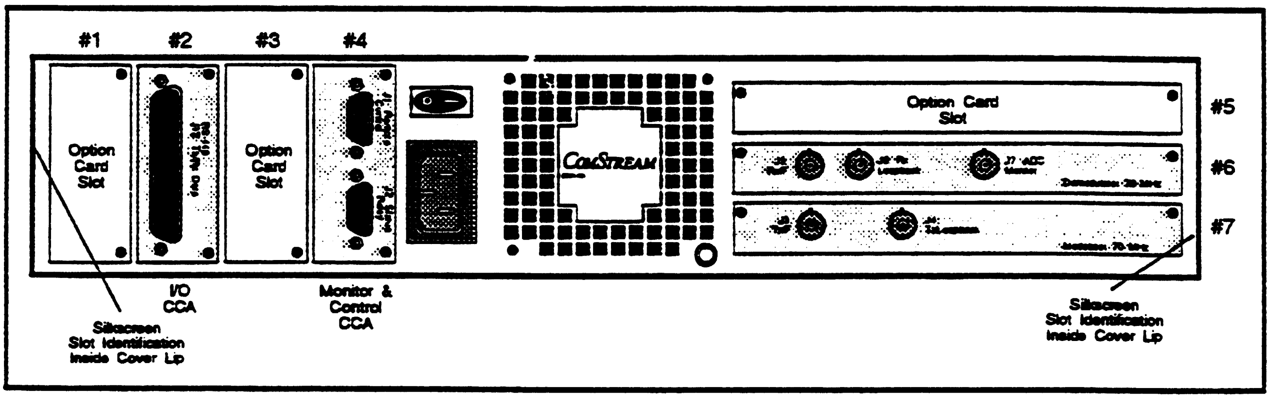
If communication needs dictate that a single modem handle the transmission or reception of multiple carriers, the CM701 can support two modulators or two demodulators. The only requirement for multiple carrier operation is the installation of an extra I/O card for the additional modulator or demodulator. Alternatively, a second demodulator or modulator can be added to a standard modem configuration. This also requires a second I/O card. A second demodulator can be used to receive a shared broadcast control channel allowing a central site to reach each modem in the satellite network.

Slot Locations and Control Addressing

The term "slot", in the CM701 context, refers to a cutout in the rear panel which accommodates a circuit card module. As shown in Figure 2.2, there are a total of seven (7) slots in the 3.5 inch tall CM701 rack-mount chassis. Modules can be installed in rear panel slots without removing the cover of the chassis. The power supply module, backplane, and control front panel are not installed in slots, since removal of the cover is required for installation or replacement of these modules. Refer to the later chapter **Troubleshooting, Self-Test, and Maintenance**, for instructions on replacing all modules, including those installed in slots, and especially those not installed in slots.

Figure 2.3 shows a rear panel view of the CM701 with slot locations clearly marked. Slot numbering goes left-to-right for the vertical module slots to the left of the fan, and top-to-bottom for the horizontal module slots to the right of the fan. The slot numbers are identified with silkscreen on the inside lip of the chassis cover at each side of the rear panel. These slot identifiers can be used for reference while cabling a CM701 in a system, or to determine the slot configuration of modules in a unit.

Figure 2.3 CM701 Rear Panel View



Quick Table-Top CM701 Functional Verification

Remove the CM701 from the carton and set it on a bench or table-top for a quick functional checkout prior to system installation or field deployment.

__ Install the IF loopback cable between J4 and J6 on the rear panel

__ Pick an AC power cord (attach a connector in accordance with local regulations and laws if the International type is selected) Refer to the Power Connector section in Chapter 5.

__ Ensure the AC switch is in the OFF or "0" position and connect the AC line cord to the CM701 rear panel and an AC outlet plug

__ Attach a remote control terminal to J1 on the rear panel using the 9-to-25 pin adapter cable - verify that the modem and terminal have matching protocol.

__ Power-up the CM701 and verify that the self-test Pass message appears on the remote control terminal, and the front panel LCD shows a Ready message

__ Verify front panel operation by pressing a few buttons

__ Verify remote control operation by issuing a few commands

__ Enable IF loopback & enable the built-in BERT

Verify that the demodulator locks & the RxSync message lights green. If not, re-initialize the CM701 using the front panel Init Factory Default command, or the remote IN command. Follow this by a remote CDC command, with a parameter of 1 for basic modem configuration, or 8 for open network configuration with a framing unit. Enable IF loopback again & verify RxSync

__ Verify an IF loopback Eb/No level of 21.0 dB

__ Clear faults with the front panel or remote control CF command

__ Both FAULT messages on the front panel should be off & the RxSync message lit green. The TestMode light will also be lit - which is okay, because IF loopback is active

__ If everything works properly, disable If loopback, power-off the unit & proceed to installation.

Note: If any step on this list fails, or functions improperly, refer to the later chapters Initial Setup and Operation and Troubleshooting, Self-Test, and Maintenance for detailed instructions and problem diagnosis.

CM701 Configuration & Setup

Using the remote control terminal or the control front panel, configure the CM701 with the operating parameters required by the system design for this installation. The basic commands are listed below. Use the remote control commands DP and DP_7 to display summary configuration parameter settings for verification.

Remote Command	Front Panel Menu	Description
TM	Config-Mod	Modulation type
TR	Config-Mod	Transmit symbol rate
TD	Config-Mod	Transmit data rate
TC	Config-Mod	FEC encoding type and code rate
TP	Config-Mod	Transmit output power level
RS	Config-Demod	Receive IF frequency
RM	Config-Demod	Demodulation type
RR	Config-Demod	Receive symbol rate
RD	Config-Demod	Receive data rate
RC	Config-Demod	FEC decoder type and code rate
EB	Monitor	Required Eb/No level
AR	** none	Required IF acquisition range
MB	Config-Mod	Internal, external, or loop timing
ML	** none	TT or ST modulator latching clock

** These entries do not appear explicitly on any front panel menu. Use the Terminal Emulator under the Control Options menu to enter these commands from the control front panel.

If it is necessary to start this configuration process over, or reconfigure an existing unit, it may be helpful to begin with the unit in its original factory configuration. This reset can be done with the control front panel Init Factory Default command or the remote control IN command, followed by an appropriate CDC remote control command. Use CDC_1 for a standard CM701 modem, and CDC_8 for an open network CM701 with an internal framing unit.

System Commissioning

Once the CM701 is installed, cabled, and configured, the following sequence of steps is recommended to validate all subsystem operations, interconnects, and operating parameters.

1. Perform a near-data-loopback to validate the connection between the DTE and the CM701. The remote control command LB_2 will initiate a near-data-loopback, as will the Loopback___NEAR control front panel command under the Config-M&C menu. If the DTE receives the transmit data back as receive data, with no errors, a successful near-data-loopback has been accomplished.

2. Perform an IF loopback to validate the CM701 transmit and receive paths, including IF modulation and demodulation. This loopback also uncovers timing problems between the DTE and the CM701. The remote control command LB_1 will initiate an IF loopback, as will the Loopback___IF control front panel command under the Config-M&C menu. If the DTE receives the transmit data back as receive data, with no errors, a successful IF loopback has been accomplished. The CM701 indicates a successful IF loopback by lighting the control front panel message RxSync green, and showing no FAULT messages once the faults are cleared with a CF remote command, or the Faults___CLEAR command under the control front panel Faults menu.

3. Perform a satellite loopback to validate the coaxial cabling between the CM701 and the outdoor radio, as well as the radio transmit and receive paths, and the satellite receive and transmit paths. This loopback is accomplished by setting the receive IF frequency of the CM701 demodulator to match the receive frequency intended for the CM701 at the other end of the satellite link. This setting will cause the CM701 to receive its own signal back from the satellite. A successful satellite loopback test is indicated by the DTE receiving its own transmitted data back error free. Similar to the IF loopback, the RxSync message should be lit green and the FAULT messages should not appear on the control front panel once the faults have been cleared. Note that the CM701 built-in BERT may be used instead of a DTE to indicate a successful satellite loopback test. Refer to the later chapter Internal BERT for details on CM701 built-in BERT operation.

4. Set up the CM701 in the intended operating configuration. Perform a far-data-loopback at the modem on the other end of the circuit. Issue a remote command LB_4 to the modem on the other end, or the command Loopback___FAR, on the control front panel. A successful far-data-loopback is indicated by the DTE receiving its own transmit data back error free. The built-in BERT can be used to validate a far-data-loopback instead of a DTE data analyzer, if necessary.

5. Complete the loopback process by initiating the same 4 steps from the other end of the satellite link. Ensure that each modem is receiving the carrier from the satellite at an Eb/No level acceptable for anticipated link availability, as predicted by the link analysis performed prior to installation. Typical levels range from 6dB to 10dB.

6. A final long-term bit error rate (BER) measurement is also recommended for at least 24 hours, and preferably an entire week. This test will demonstrate that the satellite link is operational 24 hours a day, 7 days a week, and has no periodic interruptions along the way. Sometimes neighboring carriers on the satellite will interfere, but only at certain times during the day or week. This test will also show that doppler effects of satellite motion on the circuit operation are non-existent, or at least are within tolerable limits. This test can be run with the internal built-in CM701 BERT, or with an external DTE data integrity tester.

Use the time-stamped fault feature of the CM701 (remote command VFT) to investigate once-a-day, or once-a-week fault events. Be sure to set the real time clock in the CM701 before attempting to make any sense of these time-stamped faults.

Note: If any step on this list fails, or functions improperly, refer to the later chapters Initial Setup and Operation and Troubleshooting, Self-Test, and Maintenance for detailed instructions and problem diagnosis.

__ Power-on the CM701 by pushing the rocker switch on the rear panel toward the side marked "1".

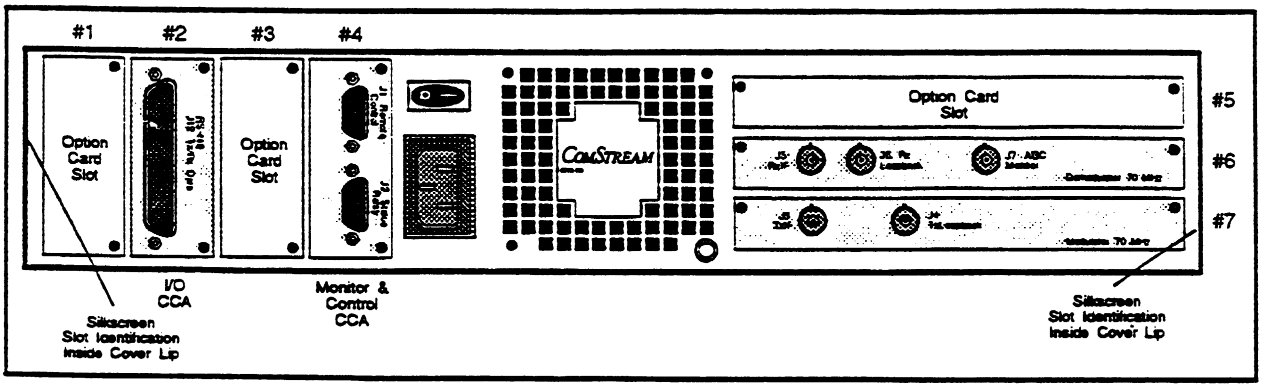
__ Watch the control front panel for the power-up message sequence and the illumination of all LED messages to verify all are operating properly. CM701 initialization and power-up self-testing takes up to 30 seconds, and results in a Pass or Fail message on the front panel LCD, followed by the Ready display.

__ The asynchronous ASCII remote control terminal displays a similar power-up message sequence, which includes the CM701 model number, software version & date, unit serial number, power-up self-test Pass/Fail indication, and a line or two for each module installed in the chassis.

If the terminal fails to display the power-up message sequence, check the cable, check the remote terminal baud rate (it should be 1200), and check the terminal data/parity (should be 7/odd) settings.

If all are in order, and the terminal still fails to display the message sequence, check the CM701 settings for remote control baud rate and data/parity configuration by entering the control front panel Config-M&C menu. Scroll through the menu until the baud rate or data/parity entry appears on the LCD display. If the parameter is incorrect, press a left or right Cursor push button to make the parameter field flash. Next press the up or down Modify push button until the correct parameter appears, then press the Enter push button. Once both parameters are correct, cycle the power switch and watch the power-up message sequence appear on the terminal display.

Figure 5.2 CM701 Rear Panel Connectors



Note: For applications using Packet Protocol, rather than ASCII, for remote control, no spontaneous power-up or sign-on messages are issued by the CM701. Packet Protocol prohibits the CM701 from issuing any messages to the remote control unit, unless a response is requested specifically by the control unit.

Packet protocol is selected using the front panel Protocol Packet menu entry under the Config M&C menu. A device address must also be specified for packet protocol, using the Packet Address menu entry under the same menu. For most packet protocol applications, the RS-485 electrical interface is also necessary. This is selected using the Remote Control RS-485 entry, also under the same M&C menu. The RS-485 interface is asynchronous, just like the RS-232, so baud rate and parity must be verified, as described previously.

Operation of the Control Front Panel

Once the unit is powered up and operational, the control front panel can be used for initial configuration, monitoring, and reporting of CM701 fault conditions.

Operation of the front panel is organized into a simple tree structure made up of command menu lists. Pressing the soft select push buttons under the LCD will bring the operator to lower levels in the tree and into command menu lists. Move up in the tree by using the push button labeled Previous. The tree is separated into three command types: Configuration, Monitor, and Faults. These selections will appear shortly after the CM701 is powered on. The command tree is shown in Figure 9.3. When the More selection appears on the LCD, it is indicating that there are more selections available at this tree level than can be viewed at one time. Selecting the More option or pressing the left or right arrow push buttons will make those additional selections visible.

Configuration parameters can be altered by pressing the Cursor push buttons (left and right arrows) or the rightmost soft select push button, which cause the LCD parameter to flash. The flashing display parameter can be changed by pressing the Modify push buttons (up and down arrows) until the desired parameter appears. The change is effected by pressing the Enter push button, which completes the command entry.

Monitor and Fault parameters can be viewed, but not changed, and there is a dedicated push button to the right of the panel with a TxEnable label above. Pressing this push button enables or disables the modulator IF transmission. The label appears white if the output power is disabled, and is illuminated green if the power is enabled.

CM701 Configuration & Set-up

Using the remote control terminal or the control front panel, configure the CM701 with the operating parameters required by the system design for this installation. Use the remote control commands DP and DP_7 to display summary configuration parameter settings for verification.

Remote Command	Front Panel Menu	Description
TS	Config-Mod	Transmit IF frequency
TM	Config-Mod	Modulation type
TR	Config-Mod	Transmit symbol rate
TC	Config-Mod	FEC encoding type and code rate
TP	Config-Mod	Transmit output power level
RS	Config-Demod	Receive IF frequency
RM	Config-Demod	Demodulation type
RR	Config-Demod	Receive symbol rate
RC	Config-Demod	FEC decoder type and code rate
MB	Config-Demod	Internal, external, or loop timing
ML	** none	TT or ST modulator latching clock

** This entry does not appear explicitly on any front panel menu. Use the Terminal Emulator under the Control Options menu to enter this command from the control front panel. Refer to the later chapter Front Panel Operation for operational instructions on the Terminal Emulator feature.

If it is necessary to start this configuration process over, or reconfigure an existing unit, it may be helpful to begin with the unit in its original factory configuration. This reset can be done with the control front panel Init Factory Default command or the remote control IN command, followed by an appropriate CDC remote control command. Use CDC_1 for a standard CM701 modem, and CDC_8 for an open network CM701 with an internal framing unit.

The factory default parameter settings for each of these configuration parameters can be found in the Remote Control chapter Remote Control Command Summary table.

Carrier Acquisition

In the standard factory configuration (AA_1), the modem will automatically acquire the receive signal within several seconds if the Eb/No level is greater than 4 dB. Once signal acquisition is complete the RxSync message on the front panel will change from white to green, and an ASCII protocol remote control terminal will display an unsolicited ST_O on the screen.

If the modem does not acquire the carrier within its timeout period, an acquisition failure error code will be displayed. The timeout period, dependent on data rate, is several seconds at a rate of 1 Mbps, and several minutes at a rate of 9.6 Kbps.

If the modem does not acquire the carrier, the external connections to the modem should be re-checked. Also the configuration parameters of the respective modulator and demodulator should be re-checked, as they may be incompatible.

Acquisition is the process by which the demodulator adjusts its frequency, phase, gain, and code word synchronization to match that of the incoming carrier. The modem will acquire the incoming carrier whenever the carrier is within ±30 KHz (default up to ±100 KHz programmable) of the most recently commanded receive synthesizer frequency, and the power is within the dynamic range specification of the demodulator. This acquisition frequency range may be customized using the remote AR command if ±30 KHz is not appropriate for an installation. Once acquired, the modem will continuously track the carrier as it moves over that range, if the frequency rate of change is small. This acquisition requirement is met, regardless of data rate, modulation type, or FEC coding.

For systems operating with high symbol rates (SR>200Ksps), the modem will acquire a valid carrier in a very brief time (1-2 seconds). For systems operating with low symbol rates, acquisition may take up to a few minutes. Lower symbol rates have images of the true carrier, at frequency offsets of SR/2 for BPSK operation and at SR/4 for QPSK, which are within the acquisition range of ±30KHz. To help ensure that the modem doesn't lock to one of these images, small frequency "bins" near the receive frequency synthesizer setting (remote command RS parameter) are searched in an iterative manner until the receive signal is found.

The modem starts acquisition at the frequency specified by the remote control RS parameter setting, plus an offset specified by the remote control AO command, and searches each frequency "bin" for a valid carrier. Bins are searched in a ping-pong fashion, starting at RS+AO, then just above, then below, then above a greater distance, then below a greater distance, etc. This continues until the full ±30 KHz acquisition range is searched, or until a carrier is found. If acquisition starts at the true frequency of the incoming carrier, it will be completed very quickly (1-4 seconds, regardless of symbol rate). Otherwise, acquisition may take up to several minutes, depending on the symbol rate and the frequency distance from RS+AO to the true receive carrier frequency.

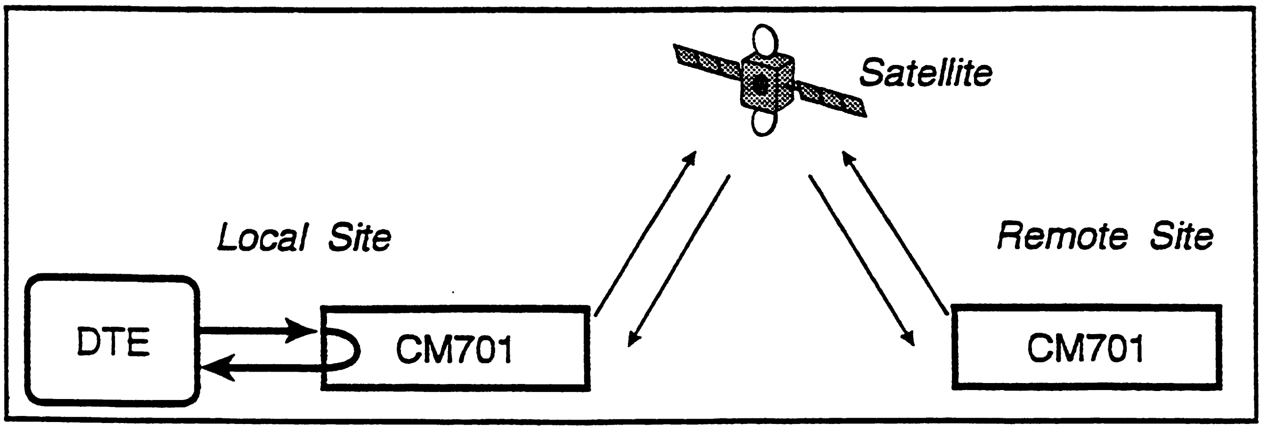
In addition, if the modem is operating with little or no noise in an uncoded mode, it may occasionally lock to an image of the true carrier. This does not occur when operating under normal satellite conditions in coded mode, with noise present on the channel.

System Validation and Fault Isolation

1. Perform a near-data-loopback to validate the connection between the DTE and the CM701. The remote control command LB_2 will initiate a near-data-loopback, as will the Loopback___NEAR control front panel command under the Config-M&C menu. If the DTE receives the transmit data back as receive data, with no errors, a successful near-data-loopback has been accomplished.

   Check the cabling and data control handshaking of the DTE if the data is not received by the DTE error-free.

Figure 5.3 Near Data Loopback

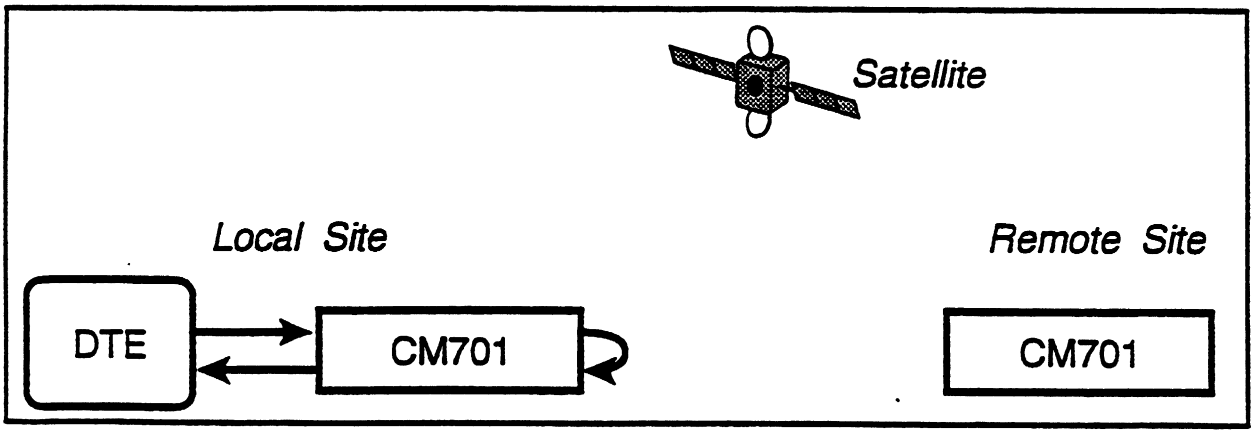


2. Perform an IF loopback to validate the CM701 transmit and receive paths, including IF modulation and demodulation. This loopback also uncovers timing problems between the DTE and the CM701. The remote control command LB_1 will initiate an IF loopback, as will the Loopback___IF control front panel command under the Config-M&C menu. If the DTE receives the transmit data back as receive data, with no errors, a successful IF loopback has been accomplished. The CM701 indicates a successful IF loopback by lighting the control front panel message RxSync green, and showing no FAULT messages once the faults are cleared with a CF remote command, or the Faults___CLEAR command under the control front panel Faults menu.

   Check modulator and demodulator configuration parameter settings for compatibility, ensure the IF loopback cable is installed, and check the clocking configurations of the DTE and CM701 if data is not received by the DTE error free.

Note: Since the CM701 TxIF was not connected to the upconverter in the previous External Connections step of this chapter, it should be connected at this time. Be sure the modulator transmit power is disabled (front panel TxEnable message white, not green), prior to connecting the upconverter to the J3:TxIF connector on the CM701 rear panel. The transmit path to the upconverter is required for the next step in loopback system validation.

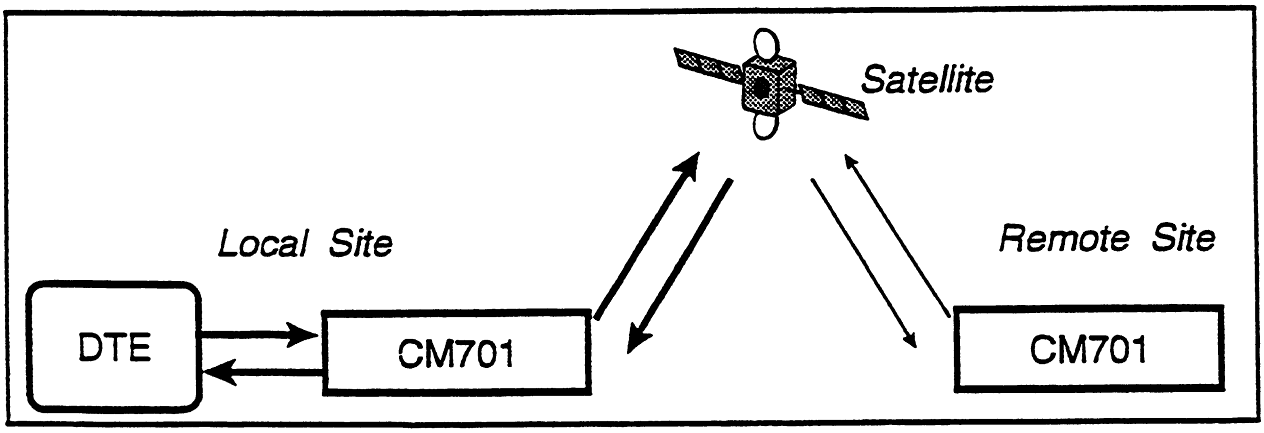
Figure 5.4 IF Loopback



3. Perform a satellite loopback to validate the coaxial cabling between the CM701 and the outdoor radio, as well as the radio transmit and receive paths, and the satellite receive and transmit paths. This loopback is accomplished by setting the receive IF frequency of the CM701 demodulator to match the receive frequency intended for the CM701 at the other end of the satellite link. This setting will cause the CM701 to receive its own signal back from the satellite. A successful satellite loopback test is indicated by the DTE receiving its own transmitted data back error free. Similar to the IF loopback, the RxSync message should be lit green and the FAULT messages should not appear on the control front panel once the faults have been cleared. Note that the CM701 built-in BERT may be used instead of a DTE to indicate a successful satellite loopback test. Refer to the later chapter Internal BERT for details on CM701 built-in BERT operation.

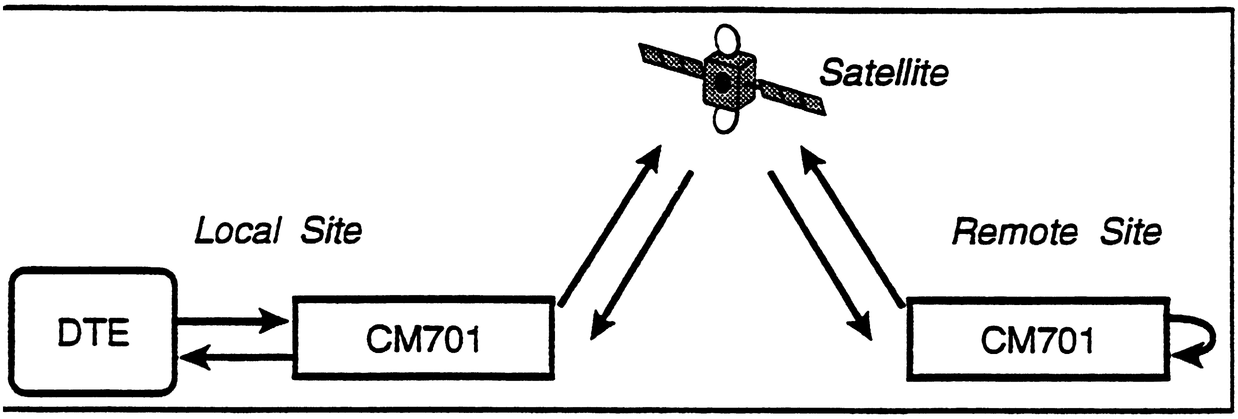
   A remote control AG_? parameter response of 255 indicates that the demodulator is not receiving a carrier. Check cabling, verify all frequency settings, and ensure that the modulator power is enabled (green TxEnable message on the front panel) for this test to be successful.

Figure 5.5 Satellite Loopback



4. Setup the CM701 in the intended operating configuration, with all loopbacks disabled. Perform a far-data-loopback at the modem on the other end of the circuit. Issue a remote command LB_4 to the modem on the other end, or the command Loopback___FAR, on the control front panel. A successful far-data-loopback is indicated by the DTE receiving its own transmit data back error free. The built-in BERT can be used to validate a far-data-loopback instead of a DTE data analyzer, if necessary.

Figure 5.6 Far Data Loopback



5. Complete the loopback process by initiating the same 4 steps from the other end of the satellite link. Ensure that each modem is receiving the carrier from the satellite at an Eb/No level acceptable for anticipated link availability, as predicted by the link analysis performed prior to installation. Typical levels range from 6dB to 10dB.

6. A final long-term bit error rate (BER) measurement is also recommended for at least 24 hours, and preferably an entire week. This test will demonstrate that the satellite link is operational 24 hours a day, 7 days a week, and has no periodic interruptions along the way. Sometimes neighboring carriers on the satellite will interfere, but only at certain times during the day or week. This test will also show that doppler effects of satellite motion on the circuit operation are non-existent, or at least are within tolerable limits. This test can be run with the internal built-in CM701 BERT, or with an external DTE data integrity tester.

   Use the time-stamped fault feature of the CM701 (remote command VFT) to investigate once-a-day, or once-a-week fault events. Be sure to set the real time clock in the CM701 (remote commands DAY and TIM) before attempting to make any sense of these time-stamped faults.

Chapter 11. External Connections

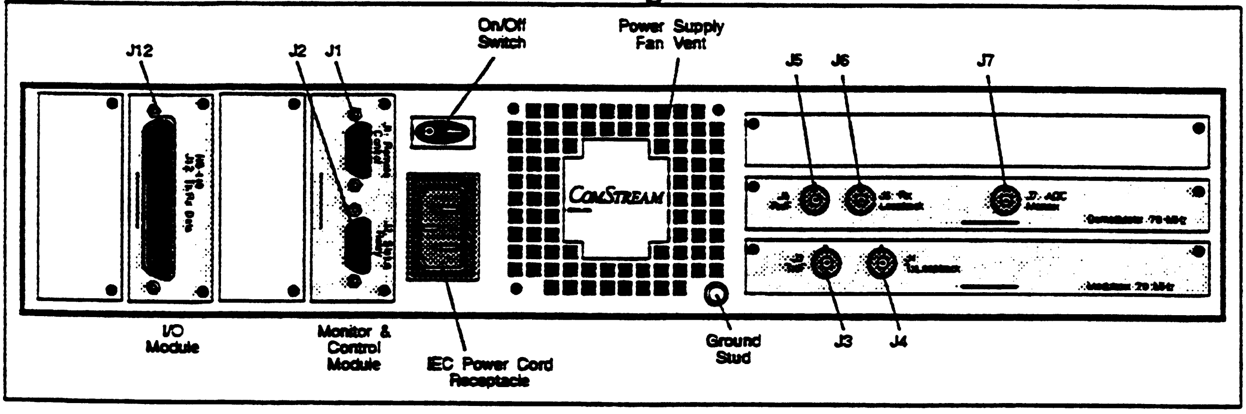
Chapter Overview

This chapter describes the external connections for a CM701 configured as a standard modem. All external connections are located on the rear panel. Because of the modular CM701 architecture, many different connector configurations are possible, depending which modules are installed. This chapter presents the external connections for a CM701 with an AC power supply module, monitor & control module, RS-449 data interface module, modulator, and demodulator. External connections for other modules, including other data interface modules, can be found in the manual insert sections for those modules.

For a standard CM701 modem, the rear panel connectors include D-type female, BNC female, and an IEC AC receptacle. The following paragraphs provide electrical specifications, physical pinouts, and functional descriptions for the connectors on each module. Refer to Figure 11.1 for a rear panel view of a CM701 configured as a standard modem.

Note: Many of the CM701 modules have LED indicators which are visible through holes in the rear panel filler plates. These indicators are used by factory technicians during the production process, and are not used during normal CM701 operation. They may be on, off, or blinking. These indicators should be ignored by CM701 users.

Figure 11.1 Rear Panel of a CM701 Configured as a Standard Modem



Chapter 13. Specifications

Modem Specifications

System

Configurations	Full duplex, receive only, transmit only
Data Rates	9.6 Kbps to 2.185 Mbps
Data Rate Flexibility	Variable rate (1 bps resolution) Single and Quad rates also available
Symbol Rates	19.2 Ksps to 2.185 Msps
Modulation Types	BPSK and QPSK
Code Rates	Sequential 1/2, 3/4, and 1 (uncoded) Viterbi 1/2, 3/4, 7/8, and 1 (uncoded)
Data Interfaces	RS-449, V.35, RS-232, DS-1, G.703 balanced, G.703 unbalanced
Scrambling	CCITT V.35 and IESS 309 (IBS)
IF Frequency	52 to 88 MHz or 104 to 176 MHz
Step size	Software programmable in 100 Hz increments
Impedance	75 Ohms (50 Ohm option)
Return loss	>= 20 dB
Channel Spacing	< 0.5 dB degradation for +10 dB carriers spaced 1.3 x symbol rate away < 0.1 dB degradation for like carriers spaced 1.3 x symbol rate away
Reference Stability	± 3 ppm ; ± 1 ppm per year
Modem Performance	
BPSK	< 0.5 dB from theory (0.3 dB typical)
QPSK	< 0.75 dB from theory (0.4 dB typical)

Decoder Performance (exclusive of Modem)	
Seq. R=1/2 56 Kbps	4.6 dB Eb/No for 10^{-7} BER
Seq. R=1/2 2.0 Mbps	5.4 dB Eb/No for 10^{-7} BER
Seq. R=3/4 56 Kbps	5.4 dB Eb/No for 10^{-7} BER
Seq. R=3/4 2.0 Mbps	6.0 dB Eb/No for 10^{-7} BER
Viterbi R=1/2	5.7 dB Eb/No for 10^{-7} BER
Viterbi R=3/4	6.8 dB Eb/No for 10^{-7} BER
Viterbi R=7/8	7.8 dB Eb/No for 10^{-7} BER
System Performance	Decoder performance + modem performance + 0.4 dB (scrambling and differential)

Modulator

Transmit Power	-5 dBm to -25 dBm
Resolution	0.1 dB steps
Accuracy	± 0.5 dB over frequency
On/Off Isolation	> 60 dB
Spurious	< -55 dBc
Spectral Shape	ComStream closed network, IESS 308/309 (IDR/IBS), or BS 7-40 (SMS) selectable
Modulator Timing	Internal and External
Stability	± 3 ppm for Internal
DeJitter (standard)	± 10 %
peak	± 2 unit intervals
DS-1	per Bell Tech Pubs 41451
CEPT	per G.832

Demodulator

Receive level	-10 dBm to -55 dBm
Aggregate	0 dBm
Acquisition Range	programmable
Carrier	± 30 KHz standard
Clock	± 100 ppm standard

Mechanical/Environmental

Size	
Width	19" Rack Mountable
Height	3.5" (2 rack units)
Depth	18"
Weight	25 pounds
Temperature	
Operating	0°C to $+50^{\circ}$C
Non-operating	-20°C to $+70^{\circ}$C
Humidity	
Operating	5 % to 95 % non-condensing
Non-operating	0 % to 100 % non-condensing
Power	
AC input	90-264 V, 47-63 Hz (auto ranging)
usage	50 watts (typical)

Chapt 13

Introduction

The Access Plus 100 continues the Clarity Series ™ tradition of providing economical network solutions while expanding the capacity, flexibility, and sophistication of network designs. This manual describes the installation, maintenance, and operation of Access Plus100 units.

The Access Plus 100 uses a combination of advanced multiplexing and compression techniques to provide the most cost effective and comprehensive access to public network services with the opportunity to maximize voice, fax, and data traffic on private leased lines. The Access Plus 100 introduces packet multiplexing to the Clarity Series solution set, complementing the traditional voice, fax and TDM data processing. Packet multiplexing in the Access Plus 100 allows combined port rates to exceed the composite rate, increasing data transmission efficiency in applications where variable throughput is acceptable. It supports up to 16 data channels which are multiplexed onto a single TDM channel.

Data ports in the Access Plus 100 can be console-configured for TDM or packetized asynchronous, HDLC/SDLC, and bisync data formats. Data processed with packet-mode formats may be passed and used within frame relay networks. Also, when used with the Clarity Intelligent Bandwidth Allocation feature (IBA), as shown in Figure 1-1, idle voice channel bandwidth may be allocated to the packet multiplexer packet band, providing even greater throughput for high speed data links.

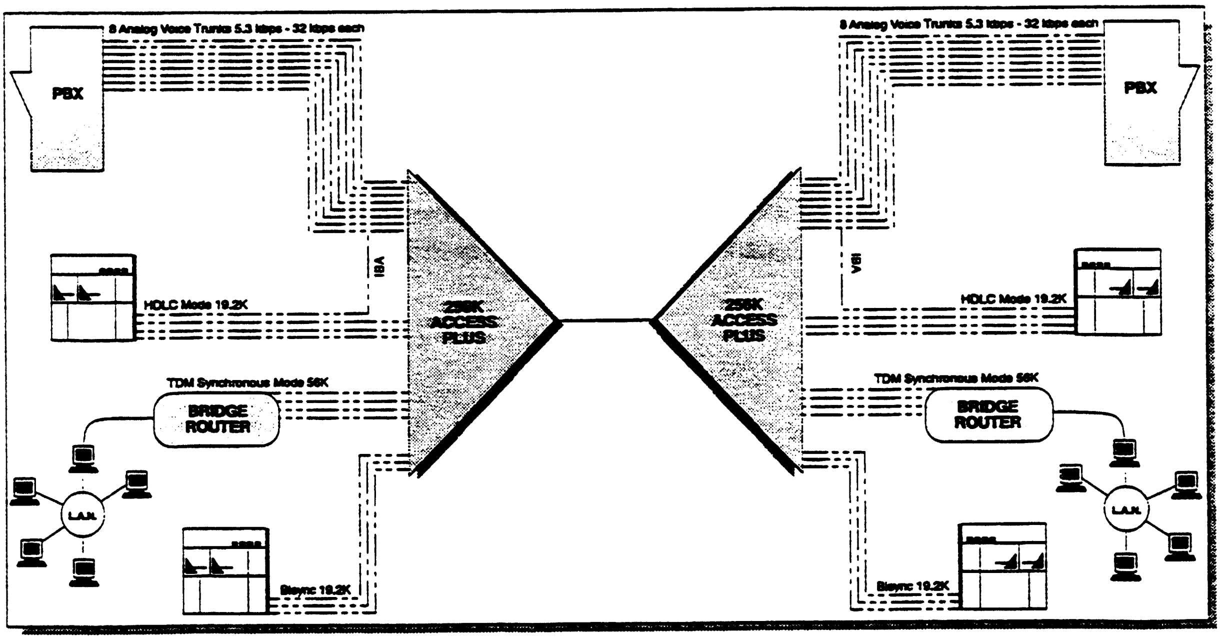


Figure 1-1. Point-to-Point Configuration

This manual provides the information to help you configure, use, and maintain the Access Plus 100 units. Separate operating instructions for use of the Access Plus with the *Clarity Vision* ™ Network Management Software (NMS) are contained in a separate Users Guide, shipped with the software.

- Chapter 2 provides a physical and functional overview of the Access Plus
- Chapter 3 describes key installation planning concepts (such as determining bandwidth allocation, and clocking) which you need to be familiar with prior to installation and contains the Site Survey and Configuration Maps
- Chapter 4 provides step-by-step instructions for installing and configuring the Access Plus
- Chapter 5 describes the command console user interface
- Chapter 6 describes monitoring features, alarms, and error messages
- Chapter 7 describes diagnostics and troubleshooting features
- Chapter 8 describes maintenance procedures
- Appendix A contains the Configuration Worksheets
- Appendix B contains a listing of replacement part numbers
- Appendix C describes the Access Plus cables available from PCSI
- Appendix D describes E & M Interconnection drawings
- Appendix E describes regulatory information (FCC regulations and a Canadian Department of Communications notice)
- Appendix F contains a listing of factory default settings
- Appendix G contains a glossary of commonly used terms.

Note that since the Access Plus 100 can provide connection to a public network, you may have to file an affidavit of signal power with your telephone company before you install and configure the Access Plus 100. Appendix D also contains a sample affidavit.

This chapter provides a physical and functional description of the components and features that are available in the Access Plus 100.

Introduction

The Access Plus 100 has a flexible, modular design. The mechanical architecture allows up to four optional stack cards to be easily installed in the chassis, supports standard PCSI telco voiceband processing cards, and provides an open-ended architecture in which new cards can be added. As shown in Figure 2-1, the optional voice cards (slot cards) are inserted vertically in the interior of the chassis and the optional cards (stack cards) that process some combination of RS-232, RS-422, V.35, T1 and/or E1 traffic are inserted horizontally at the rear of the chassis. The Access Plus 100 can be either shelf mounted or rack mounted using a fixed shelf.

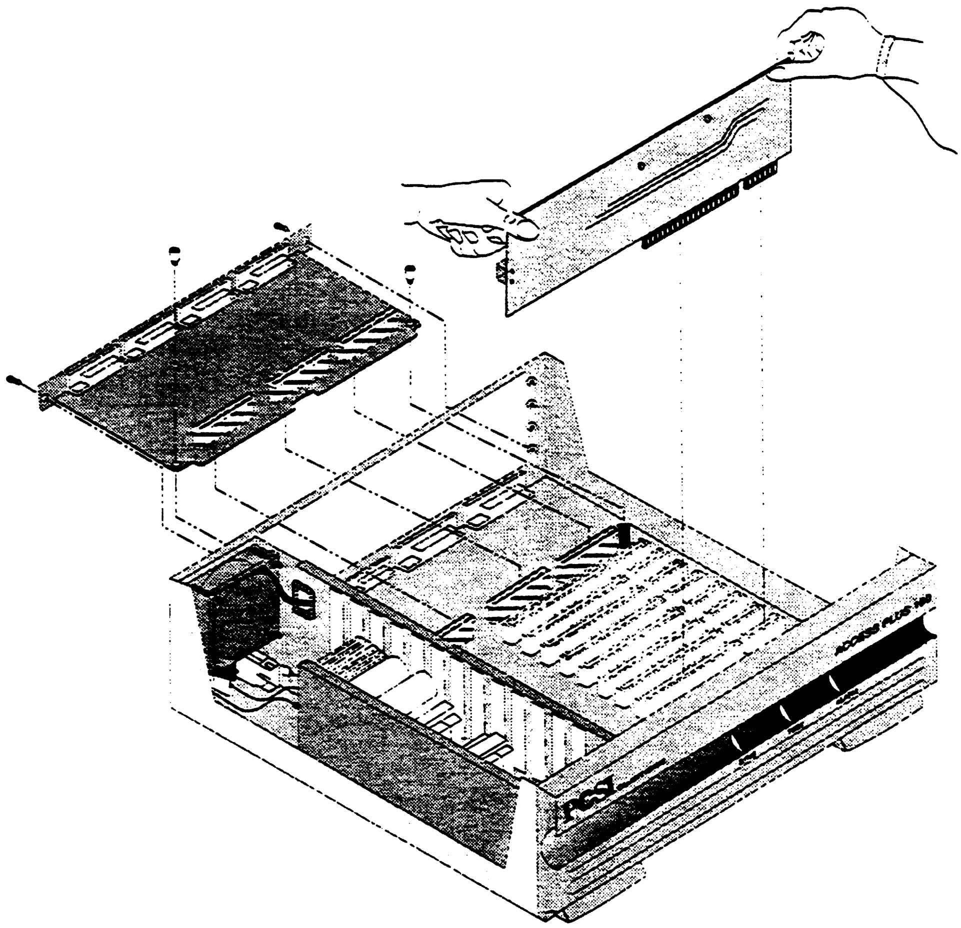


Figure 2-1. "Stack" Architecture of the Access Plus 100

Physical Description

The attractively designed front panel of the Access Plus 100, shown in Figure 2 -2, displays the sync, test, and alarm indicators .

Front Panel Overview

Each indicator either illuminates or emits a flash pattern that, as described in Chapter 6, provides basic information about the unit's operating state.

SYNC Indicator

The green SYNC indicator illuminates when correct network frame sync signals are detected on the network port interface. When the unit is in pass-through mode, the SYNC indicator flashes.

TEST Indicator

The yellow TEST indicator illuminates when the unit is in a self-test mode, an internal reset mode, or during diagnostic procedures.

ALARM Indicator

The red ALARM indicator illuminates when a system alarm is detected. The ALARM indicator remains lit as long as the alarm condition persists.

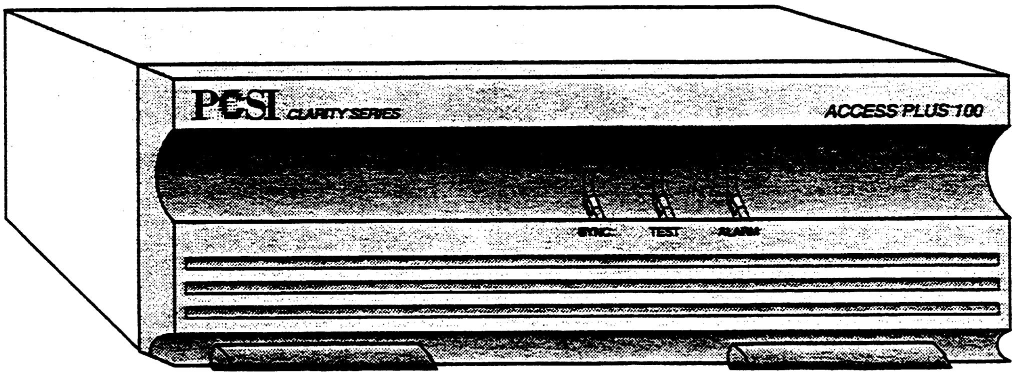


Figure 2-2. Access Plus 100 Front Panel

Rear Panel Overview

The rear of the Access Plus 100, as shown in Figure 2 -3, provides connectors for data, voice and network ports. Optional cards are available to adapt the Access Plus 100 to meet the requirements of numerous user applications. These optional cards are:

- Voice/FAX (VFAX) Card
- Digital Voice/FAX (DVFAX) Card
- Hybrid Data Module (HDM) Card
- Expansion Data Module (EDM) Card
- Input/Output Port (IOP) Card
- Digital Subscriber (DSUB) Card
- Digital Network (DNET) Card

Note that not all optional card types are represented in Figure 2-3.

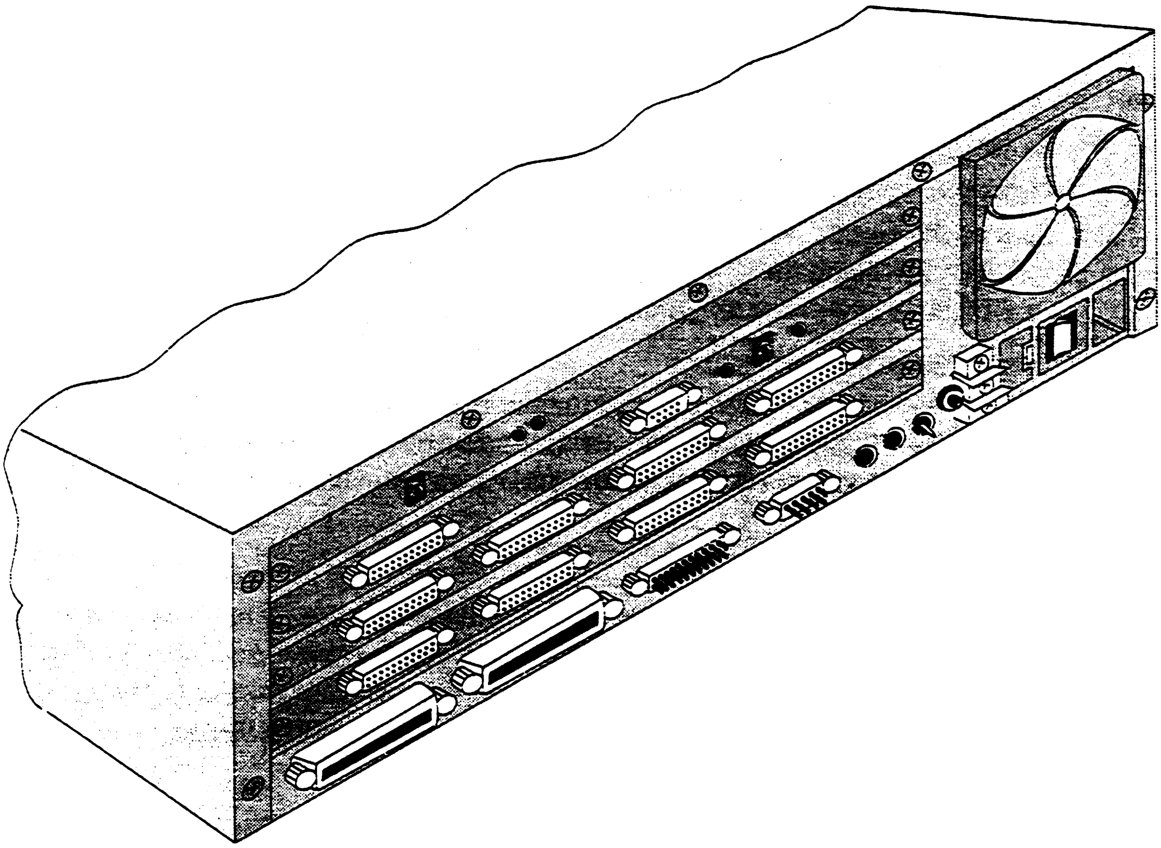


Figure 2-3. Access Plus 100 Rear Panel

Voice Ports

The voice ports are implemented with two 50-pin RJ2HX connectors that provide connection for up to eight 2-wire FXO/FXS or 2- and 4-wire E&M telco channels. Loop start is supported for both FXO and FXS operation, while ground start is supported for FXS operation. Two- or 4-wire E&M operation can be configured for types 1 through 5 with each type in either normal or reverse. An RJ11 Adapter assembly is available that allows the connection of {TBD} cables with RJ11 plugs to the unit.

Network Port (Base Unit)

The base unit network port is implemented with a single male DB25 connector that provides connection to a synchronous serial channel. This port is factory-configurable to function as a V.35 or RS-422 interface and connects to a network link facility that interconnects Access Plus units.

Console Port

The console port is implemented with a single male DB9 connector that provides connection to an asynchronous serial channel. This port is switch-configurable to operate as either a RS-232 or RS-485 interface and connects to a user console or network management system.. This switch is located on the chassis rear panel.

RS-232/RS-485 Switch

The RS-232/RS-485 switch selects RS-232 or RS-485 operation for the console port interface. The RS-232 position is normally used when the unit is operated in the console mode. The RS-485 position is selected when the unit is used in a multidrop network management system network.

External Alarm Input (In)

The external alarm input connector accepts a standard 3.5 mm stereo plug. If an external device provides a contact closure between the +12 V output and the alarm input on the connector, the Access Plus 100 registers and reports an alarm condition.

External Alarm Output (Out)

This connector accepts a standard 3.5 mm stereo plug. If the Access Plus 100 detects an internal or external alarm condition, it closes the contacts of the external alarm relay. Outputs from a unit's external alarm can be linked to other units, making a single alarm output available for multiple units.

Data Ports

Data ports are implemented with a female DB25 connector and are provided by the following optional stack cards: Hybrid Data Module (HDM), Expansion Data Module (EDM), Input/Output Port (IOP) and Digital Network (DNET) Cards (these cards are discussed in more detail below).

The unit supports one HDM Card and up to three EDM Cards. An HDM Card is <u>required</u> if any EDM Cards are used. Both cards provide four data ports with one of those four ports factory-configurable to RS-232, RS-422 or V.35 operation. The remaining three ports on each card function as RS-232 interfaces. For the HDM Card, all four ports are console-programmable to process asynchronous or synchronous protocols in packet mode, or synchronous protocols in TDM mode. All four ports of the EDM Card are console-configurable to process asynchronous or synchronous protocols In packet mode.

The unit supports up to four IOP Cards, with each IOP Card providing four data ports. Each port is console-configurable to function as either a network port or a data port. Each port is factory-configured with a RS-232, RS-422 or V.35 interface. All four ports are console-configurable to process either asynchronous or synchronous protocols in TDM mode.

The unit supports one DNET Card. In addition to either a T1/E1 network port, the DNET provides one data port that is factory-configured as either a RS-422 or V.35 interface and that processes high-speed synchronous protocols at rates up to 1.536 Mbps.

Subscriber T1/E1 Port

The unit supports one Digital Subscriber (DSUB) Card which provides one subscriber port. The DSUB Card is available in two T1 versions both using a RJ48 connector for the subscriber port, and four E1 versions, of which two use a RJ48 connector and two use BNC connector pairs for the subscriber port. The DSUB Card subscriber port therefore can connect to either a T1 or E1 transmission facility. Both the D4 super-frame and the AT&T Pub 54016 and ANSI T1.403 Extended Super Frame (ESF) formats are supported for T1 operation, and the CCITT G.704 and G.732 super-frame format is supported for E1 operation.

Network T1/E1 Port

The unit supports one Digital Network (DNET) Card which provides one network port. The DNET Card is available in two T1 versions both using a RJ48 connector for the network port, and four E1 versions two of which use a RJ48 connector and the other two use BNC connector pairs for the subscriber port. The DNET Card network port therefore can connect to either a T1 or E1 transmission facility. Both the D4 super-frame and the AT&T Pub 54016 and ANSI T1.403 Extended Super Frame (ESF) formats are supported for T1 operation, and the CCITT G.704 frame and G.732 super-frame formats are supported for E1 operation.

Power Switch

The power switch controls the application of the primary power source to the unit. The power source is protected from specific unit malfunctions by a fuse. The fuse is housed in the power switch assembly on the rear panel.

Protected Earth (PE)

The PE terminal provides an external connection to the chassis which is connected to safety/earth ground.

Functional Description

The functional architecture of the Access Plus 100, as illustrated in Figure 2-4, includes the base unit plus the optional cards of VFAX Card, DVFAX Card, DSUB Card, DNET Card, HDM Card, EDM Card and Ringer Card. Refer to Appendix B for a listing of card and other assemblies.

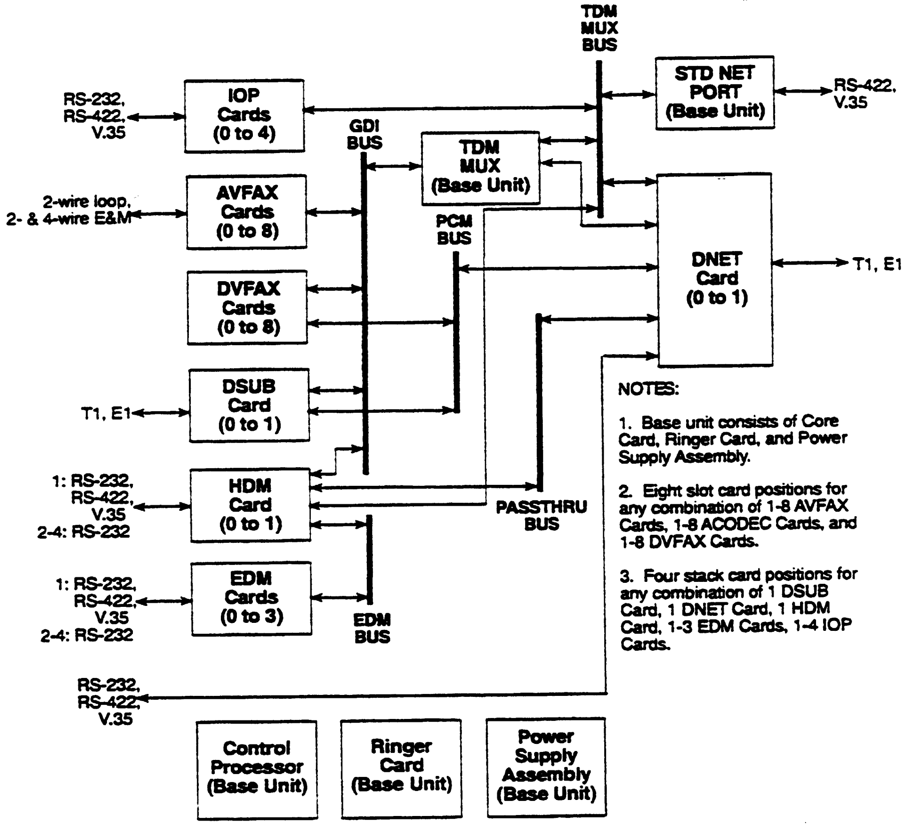


Figure 2-4. Access Plus 100 Functional Architecture

Base Unit

The base unit contains the basic processors and interfaces used by all unit configurations of the Access Plus 100. These include:

- Control Processor
- Console Port Interface
- TDM Multiplexer
- Voice Port Interfaces
- Network Port Interface.

Control Processor

The control processor controls the operation of the unit by executing commands from the local command console via the console port or from the control processor (CP) control channel of a network Composite Channel received from the associated network link. It also maintains and provides status and statistics from the various telecommunication and diagnostic operations performed by the unit to the user and/or to the CP control channel.

TDM Multiplexer

The TDM multiplexer time-division multiplexes/demultiplexes voice and data information from/to the VFAX, DVFAX, HDM and IOP Cards to/from the Composite Channel of the base unit network port or the network ports of the IOP Card.

Base Unit Network Port Interface

The base unit network port interface provides the interfacing functions needed to transmit/receive a TDM-multiplexer-processed Composite Channel to/from a V.35 or RS-422 network link.

Console Port Interface

The console port interface provides the interfacing functions needed to transmit/receive Control Processor responses/commands to/from a user console or a network management system.

Voice Port Interface

The voice port interface, in conjunction with the VFAX Cards, provides interfacing functions for up to 8 telco channels. Each port is individually console-configurable for 2-wire FXS, 2-wire FXO or 2- and 4-wire E&M operation.

Hybrid Data Module (HDM) Card

The Hybrid Data Module Card (HDM) has four data port interfaces. One port is factory-configurable to operate as a RS-232 RS-422 or V.35 interface. The remaining three ports operate as RS-232 interfaces. All four ports are console-configurable to operate in either TDM mode or packet mode. The unit supports installation of a single HDM Card.

If the data port is configured for TDM mode, the data to/from this port is mapped to a TDM sub-channel of a network Composite Channel by the TDM multiplexer as the base unit. A TDM mode port is console-configurable to process synchronous protocols.

If the data port is configured for packet mode, the data to/from the port is processed by the packet multiplexer which generates a packet band. The packet band is subsequently mapped to a TDM sub-channel on a network Composite Channel by the TDM multiplexer.

The HDM Card is an optional stack card with connectors available at the rear of the chassis.

Expansion Data Module (EDM) Card

Up to three Expansion Data Module (EDM) Cards can be concurrently installed in a unit, providing an additional 12 packet-mode data ports. The use of EDM Cards requires the installation of a HDM Card. The EDM Card has four data port interfaces, all of which support packet-mode processing. One port is factory-configured to operate as a RS-232, RS-422 or V.35 interface.
The remaining three ports operate as RS-232 interfaces.

In packet mode, the data to/from the port is processed by the packet multiplexer on the HDM Card, resulting in the generation of a packet band. The packet band is subsequently mapped to a TDM sub-channel on a network Composite Channel by the TDM multiplexer.

The EDM Card is an optional stack card with connectors available at the rear of the chassis.

Digital Subscriber (DSUB) Card

The Digital Subscriber Card (DSUB) provides "subscriber side" access to the 24 DS0 channels of a T1 transmission facility or to the 32 DS0 channels of an E1 transmission facility. The unit supports the installation of a single DSUB Card. Within the Access Plus, the DS0s are bidirectionally transferred between the DSUB Card and the DVFAX Cards for voiceband compression/decompression, or between the DSUB Card and the DNET Card, if one is installed. Six versions of the DSUB Card are available:

- T1 Short Haul,
- T1 Long Haul,
- E1 Short Haul 120 Ohm,
- E1 Short Haul 75 Ohm,
- E1 Long Haul 120 Ohm,
- E1 Long Haul 75 Ohm.

The DSUB Card is an optional stack card with connectors available at the rear of the chassis.

Digital Network (DNET) Card

The Digital Network (DNET) Card provides a T1 Multiplexer with "network side" access to the 24 DS0 channels of a T1 transmission facility or to the 32 DS0 channels of an E1 transmission facility. The unit supports the installation of a single DNET Card. On the subscriber side, the T1 multiplexer connects up to four TDM multiplexer Composite Channels, the DSUB Card via the internal PCM Bus, the HDM Card or the IOP Card via the internal Pass-thru Bus, and an Nx56/64 port on the rear chassis. The NX56/64 port on the DNET Card is factory-configured for RS-232, RS-422 or V.35 electrical interface operation. Six versions of the DNET Card are available:

- T1 Short Haul,
- T1 Long Haul,
- E1 Short Haul 120 Ohm,
- E1 Short Haul 75 Ohm,
- E1 Long Haul 120 Ohm,
- E1 Long Haul 75 Ohm.

The DNET Card is an optional stack card with connectors available at the rear of the chassis.

Digital Voice/FAX (DVFAX) Card

The Digital Voice/FAX Card implements four voiceband signal digital processing channels. Up to eight DVFAX Cards can be installed in a unit. The DVFAX Card is available in a standard-performance and a high-performance version. On the subscriber side, the DVFAX Card bidirectionally transfers DS0s of uncompressed voice and signalling with the DSUB Card. On the network side, this card bidirectionally transfers compressed information with one or more Composite Channels processed by the internal TDM multiplexer. The base unit TDM multiplexer, in turn, bidirectionally transfers Composite Channel information with either the base unit network port or, if installed, the DNET Card T1 multiplexer.

The console-configurable features for the DVFAX Card are:

1. Voice compression rates of:
   - ATC: 7.47 to 32 kbps in increments of 533 bps
   - CELP: 5.33 kbps, 8 kbps and 9.6 kbps.
2. Echo cancellation per CCITT G.165 for near-end echoes delayed by 0 to 32 msec and support for an Echo Return Loss (ERL) greater than 6dB.

The DVFAX Card is an optional slot card installed in the interior of the chassis.

Input/Output Port (IOP) Card

The Input/Output Port (IOP) Card functionally connects to the base unit TDM multiplexer and provides four ports each console-configurable as a data port or a network port. Up to four IOP Cards can be installed in a unit. Each port is factory-configured for RS-232, RS-422 or V.35 electrical interface operation. Port #1 may be console-configured to bidirectionally transfer information with a "subscriber side" port of the T1 multiplexer on the DNET Card, if one is installed. Moreover, port #1 can be console-configured to bidirectionally pass through information with port #4 which is console-configured to function as a network port.

The IOP Card is an optional stack card with connectors available at the rear of the chassis.

Voice/FAX (VFAX) Card

Up to eight VFAX Cards can be installed in a unit. All VFAX Card functions are accessed via two 50-pin RJ2HX connectors on the rear panel. The VFAX Card has a single voice port. The analog voiceband signal stream of the telco channel connected to this port can be composed of voice, fax modem, or data modem signals. The console-configurable features for the VFAX Card are:

1. Voice compression rates of:
   - ATC: 7.47 to 32 kbps in increments of 533 bps
   - CELP: 5.33 kbps, 8 kbps and 9.6 kbps.
2. Echo cancellation per CCITT G.165 for near-end echoes delayed by 0 to 32 msec and support for an Echo Return Loss (ERL) greater than 6dB.
3. Transmit and receive gains within the range of -25.4 dB to +25.4 dB in 0.2 dB increments.
4. Full V.29, 9.6 kbps Group III fax rate.
5. The following telco physical interfaces on two 50-pin telco connectors:
   - FXS or FXO
   - FXS
   - 2-Wire or 4-Wire E&M Types I, II, III, IV, or V, normal or reverse.

The VFAX Card is an optional slot card installed in the interior of the chassis.

Ringer Card

The Ringer Card generates the -48 VDC and ringer waveform required by the telco interfaces of the VFAX cards.

The Ringer Card is an optional slot card installed in the interior of the chassis.

Power Supply

The Access Plus 100 unit uses a 175 watt power supply as a standard assembly. An optional 310 watt power supply is available for certain unit configurations. Both units accept input voltage ranges of 90 to 125 VAC and 180 to 250 VAC.

Specifications

All specifications are subject to change without notice.

Analog Voice Ports

Electrical Interface	Provisions for E&M signalling include two 50-pin RJ2 connectors (for up to eight channels). Signalling type (E&M I, II, III, IV, or V, normal or reverse) can be specified for all channels. Supports Loop Start/Ground Start signalling for FXO. FXO or FXS (Ground Start only) operation is supported through the Telco connector.
Echo Cancellation	Echo cancellation for Fax III meets or exceeds CCITT G.165 for near-end echoes delayed by 0 to 32 msec. Supports minimum Echo Return Loss (ERL) greater than 6 dB. Echo canceller is console-configurable, or can be automatically disabled by modem tone per CCITT specifications. The automatic tone disabling feature is console-configured. Non-linear processing (also referred to as NLP, center clipping, or residual echo suppression) is console-configured.
Signalling	Transports pulse signalling and DTMF transparently. Supports delay, immediate and wink start on E & M leads. Supports CCITT Signalling System Number 5, Blue Book Volume VI Fascicle VI.2. Supports British Post Office Requirement 1165, Section 7 (SSAC-15).
Voice Levels	Transmit and receive levels are console-configurable for each voice channel within the range of -25.4 dB to +25.4 dB in 0.2 dB increments.
Codec Performance	Transports analog modem data at 300 bps (Bell 103 or CCITT V.21), 1200 bps (Bell 212A or CCITT V.22), 2400 bps (V.22 bis) and Group III facsimile at 2400 bps (V.27 ter).
Fax III	Transports analog modem data (BER $<10^{-5}$) at 4800 bps (V.27) and facsimile at 4800 bps (V.27 ter). Supports full V.29 9.6 kbps Group III fax rate. Fax III channels allocated 9.6 kbps or more will process voice, signalling, and full 9.6 kbps fax on demand without intervention between automatic stations. Channels allocated less than 9.6 kbps also transport Group III fax transparently at 7.2 kbps, or 4.8 kbps depending on available bandwidth. Processing latency in either the transmit or receive direction is less than 400 ms. Supports auto fallback and tolerates network delays of up to 1 second.
Voice Compression	Provides high-quality voice at rates of 5.33 kbps, 8 kbps, and 9.6 kbps with CELP and rates from 7.47 to 32K at 533 bit intervals with ATC.

Data Ports

Each data port is accessed via a female DB25 connector.

Hybrid Data Module (HDM) Card Assembly

Provides four data port interfaces with three ports operating as RS-232 interfaces and one port factory-configurable to RS-232, RS-422, or V.35 operation. All four ports are console-configurable to either TDM mode or packet mode.
The installation of one HDM Card is supported.

The data rate for each port is individually console-configurable. The data rates listed in Table 2-1 are supported for processing asynchronous protocols in packet mode and synchronous protocols in packet mode and TDM mode. Synchronous data rates must be within a tolerance of ±1000 PPM.

Expansion Data Module (EDM) Card Assembly

Provides four data port interfaces with three ports operating as RS-232 interfaces and one port factory-configurable to RS-232, RS-422, or V.35 operation. All four ports support packet mode such that each port is console-configurable to process either Bisync, HDLC/SDLC or an asynchronous protocol. Up to three Expansion Data Module (EDM) Cards can be installed with one HDM Card.

The data rate for each port is individually console-configurable. The data rates listed in Table 2-1 are supported for processing asynchronous protocols in packet mode and synchronous protocols in packet mode and TDM mode. Synchronous data rates must be within a tolerance of ±1000 PPM.

Input/Output Port (IOP Assembly

RS-422 or V.35 operation. Up to four IOP Cards can be installed.
The data rate for each port is individually console-configurable. The data rates listed in Table 2-1 are supported for processing asynchronous protocols in packet mode and synchronous protocols in packet mode and TDM mode. Synchronous data rates must be within a tolerance of ±1000 PPM.

Digital Network (DNET) Card Assembly

Provides one NX56/64 port for connection to a high-speed DTE which is mapped by a T1 Multiplexer to/from one or more DS0s of the T1 or E1 frames bidirectionally processed by the network port of the DNET Card. Factory-configured for RS-422 or V.35 operation.

The data rate for each port is individually console-configurable. The data rates listed in Table 2-1 are supported for processing within a tolerance of ±1000 PPM.

Network Ports

Base Unit Network Port

Factory-configurable for V.35 or RS-422 operation with a male DB25 connector.

The data rate for each port is individually console-configurable. The data rates listed in Table 2-1 are supported for processing synchronous protocols in TDM mode with a tolerance of ±1000 PPM.

Input/Output Port (IOP) Assembly

Provides two network ports, each factory-configured for RS-232, RS-422 or V.35 operation and each console-configurable as a TDM mode data port or network port. Each port provides a female DB25 connector. Up to four IOP Cards can be installed.

The data rate for each port is individually console-configurable. The data rates listed in Table 2-1 are supported for processing synchronous protocols in TDM mode. Synchronous data rates must be within a tolerance of ±1000 PPM.

T1 Ports

For both the DSUB Card and DNET Card T1 ports:
Line Code: AMI, B8ZS
Framing Format: D4, ANSI T1.404 ESF, AT&T Pub 54016
Pulse Characteristics: AT&T Pub 62411 compliant
Output Amplitude: 2.4 to 3.3 volts peak to base
Receiver Sensitivity, Long Haul: 0 to -26 dBm
Receiver Sensitivity, Short Haul: 0 to -13.6 dBm
Line Buildout, Long Haul: 0 dB, -7.5 dB, -15 dB, -22 dB
Line Distance, Short Haul: 0 to 655 feet
Line Distance, Long Haul: 0 to 6000 feet
Connector: RJ48

E1 Ports

For both the DSUB Card and DNET Card E1 ports:
Line Code: AMI, HDB3
Framing Format: CCITT G.704 and G.732
Output Amplitude: 2.7 TO 3.3 peak to base
Receiver Gain, Long Haul: 0 to 43 dBm:
Receiver Gain, Short Haul: 0 to 13.6 dBm:
Line Distance, Short Haul: 0 to 655 feet
Line Distance, Long Haul: 0 to 2.6 kilometers
Connector: RJ48, BNC pair

Table 2-1: Data Rates (bits/sec) for the Data Ports of the HDM, EDM and IOP Cards, the HDM Card packet band, and the Network Ports of the base unit and the IOP Cards. Limitations are specified in the notes below.

50	3734	11200	28800	74667	252000
75	4000	12000	29867	84000	256000
150	4267	12800	32000	89600	268800
300	4667	14000	33600	96000	288000
600	4800	14400	36000	100800	336000
1200	5334	14934	37334	112000	384000
1334	5600	16000	38400	115200	403200
1600	6000	16800	42000	126000	448000
1867	6400	18000	44800	128000	504000
2000	7200	18667	48000	134400	512000
2134	7467	19200	50400	144000	576000
2400	8000	21334	56000	149334	672000
2667	8400	22400	57600	168000	806400
2800	9334	24000	64000	192000	1008000
3200	9600	25200	67200	201600	1344000
3600	10667	28000	72000	224000	2016000

1. The base unit network port of P3 and the IOP Card network ports of X3 and X4 support rates from 1200 to 512000 inclusively. However, the IOP Card supports rates of 128000, 256000, 384000 and 512000 only in EXTERNAL clock mode. The base unit P3 port supports 256000 only in INTERNAL and EXTERNAL clock mode, and 512000 only in EXTERNAL clock mode.
2. Data port 1 of the HDM and EDM Cards, console-configured for TDM mode, supports rates from 1200 to 2016000 inclusively. Note that for rates above 19200, the port should be factory-configured for V.35 or RS-422 interface operation.
3. All ports of the HDM and EDM Cards, console-configured for packet mode and asynchronous protocol processing, support rates from 50 to 128000 inclusively. If console-configured for packet-mode and BISYNC or HDLC protocol processing, these ports support rates from 1200 to 2016000 inclusively. Note that for rates above 19200, the port should be factory-configured for V.35 or RS-422 interface operation.
4. All data ports of the IOP Card support rates from 1200 to 512000. However, the IOP Card supports rates of 128000, 256000, 384000 and 512000 only in EXTERNAL clock mode.
5. The HDM Card packet band supports rate of 1200 to 504000 inclusively with the exception of 256000.

Table 2-2: Data Rates for the NX56/64 Port of the Digital Network Card.

NX56	RATES	NX64	RATES
56000	952000	64000	1088000
112000	1008000	128000	1152000
168000	1064000	192000	1216000
224000	1120000	256000	1280000
280000	1176000	320000	1344000
336000	1232000	384000	1408000
392000	1288000	448000	1472000
448000	1344000	512000	1536000
504000	1400000	576000	1600000
560000	1456000	640000	1664000
616000	1512000	704000	1728000
672000	1568000	768000	1792000
728000	1624000	832000	1856000
784000	1680000	896000	1920000
840000	1736000	960000	1984000
896000	1792000	1024000	2048000

Console Port

Interface	Provides a single port with a male DB9 connector and is switch-configurable to RS-232 or RS-485 operation. An external driver is required for RS-485 operation. The data rate is console-configurable to support the following data rates: *0, 300, 1200, 2400, 4800, 7200, 9600.*

Miscellaneous

AC Line Requirements	90 to 125 VAC, or 180 to 250 VAC 47 to 63 Hz, 350 watts maximum	
Power Consumption Maximum Watts):	Base unit:	{TBD}
	VFAX Card:	{TBD}
	DVFAX Card:	{TBD}
	IOP Card:	{TBD}
	HDM Card:	{TBD}
	EDM Card:	{TBD}
	DSUB Card:	{TBD}
	DNET Card:	{TBD}
Environmental	0 to 50 Deg. C (operating ambient) -20 to +80 Deg. C (storage ambient) 0 to 95% relative humidity, non-condensing	
Size	5.25" H x 17.6" W x 18" D overall. Compatible with fixed shelf rack-mounting.	
Weight	25.5 lbs.	

The following diagrams show interconnections that are supported when configuring the Access Plus 100 voice port for E&M operation.

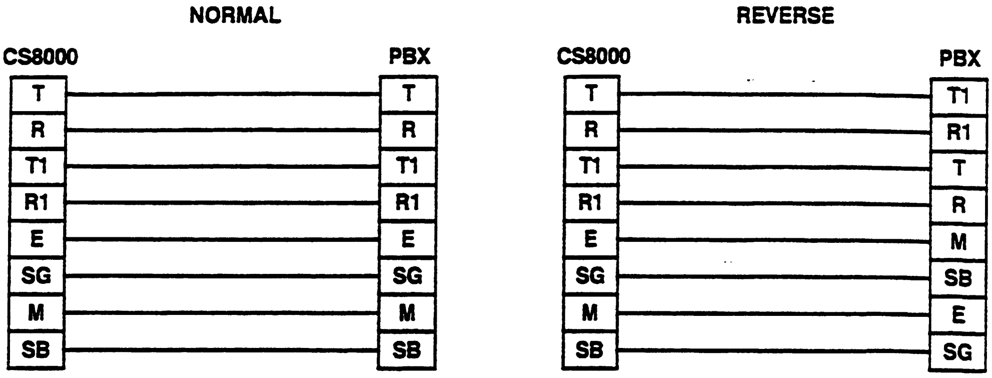


Figure D-1. Type 1, E & M

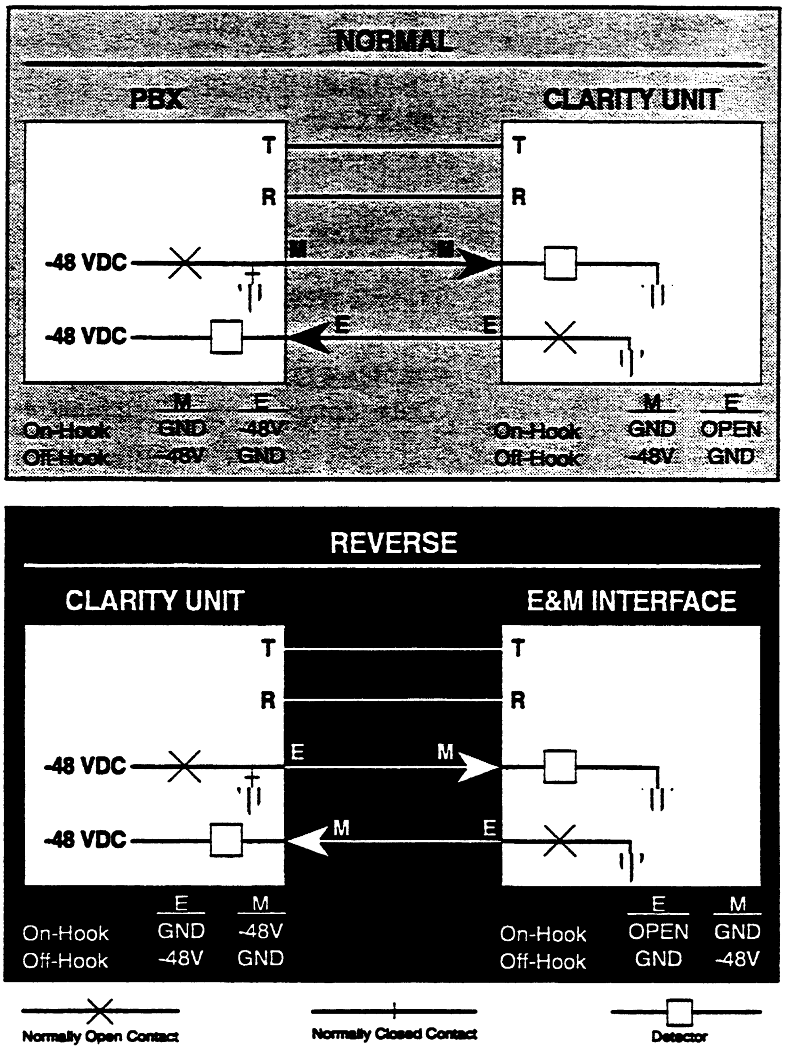


Figure D-2. Type 1, 2- Wire E& M

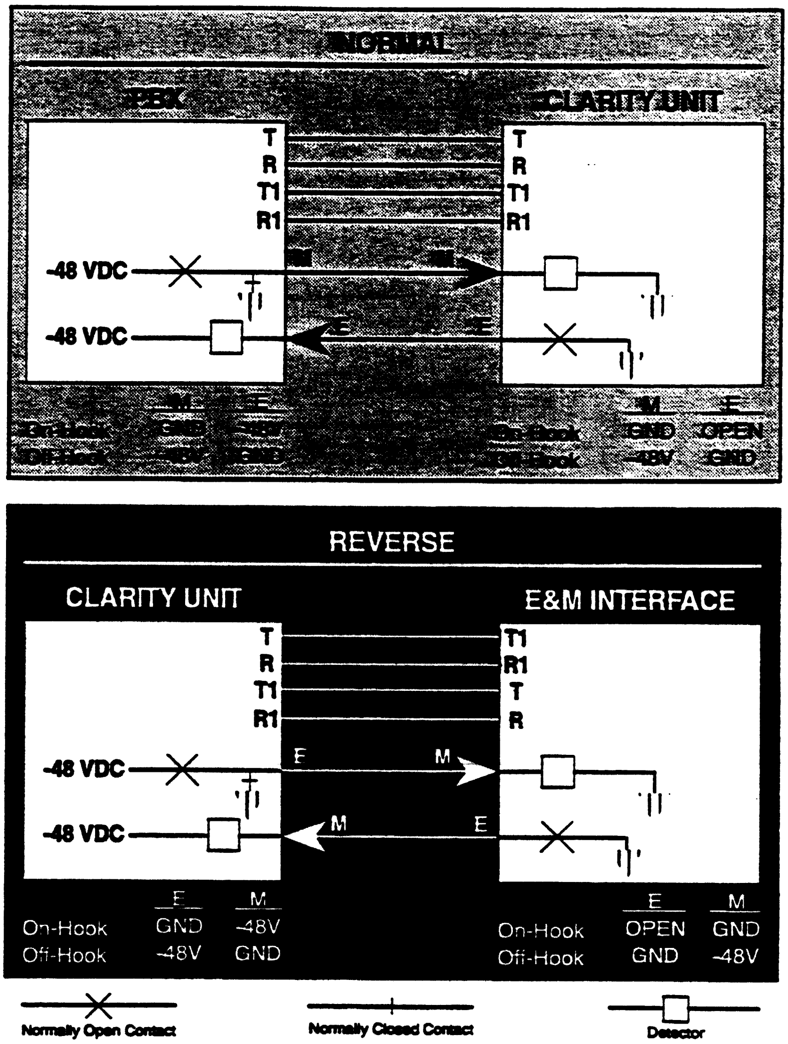


Figure D-3. Type 1, 4-Wire E&M

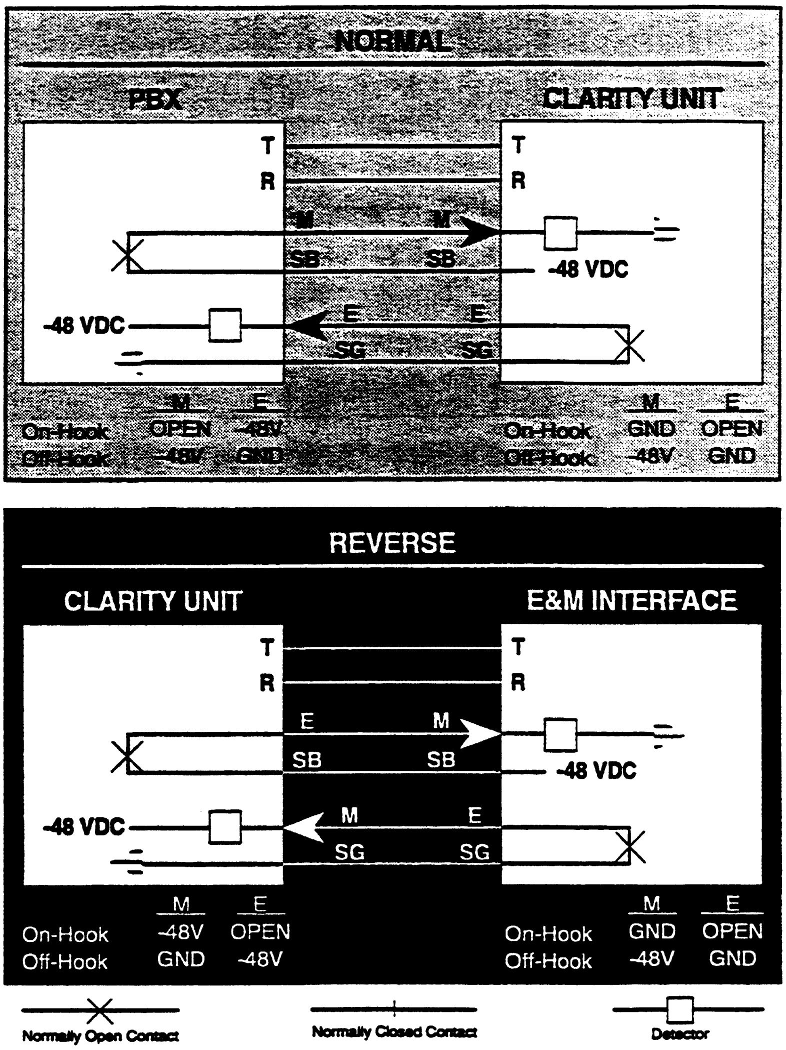


Figure D-4. Type 2, 2-Wire E&M

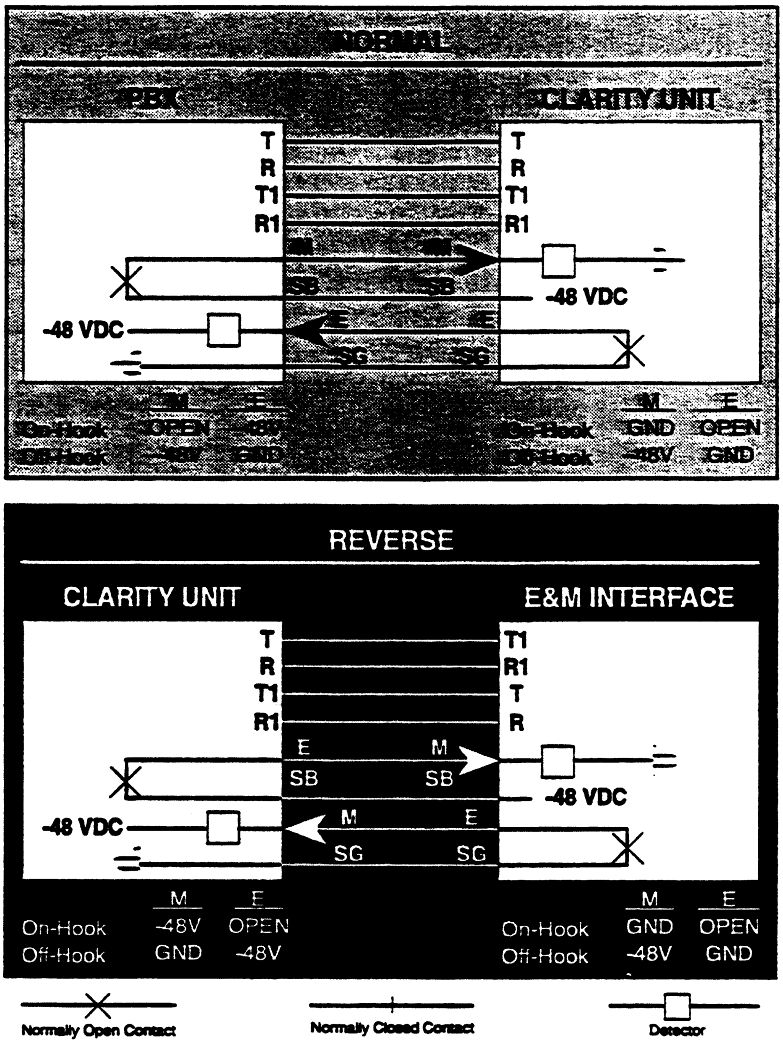


Figure D-5. Type 2, 4-Wire E &M

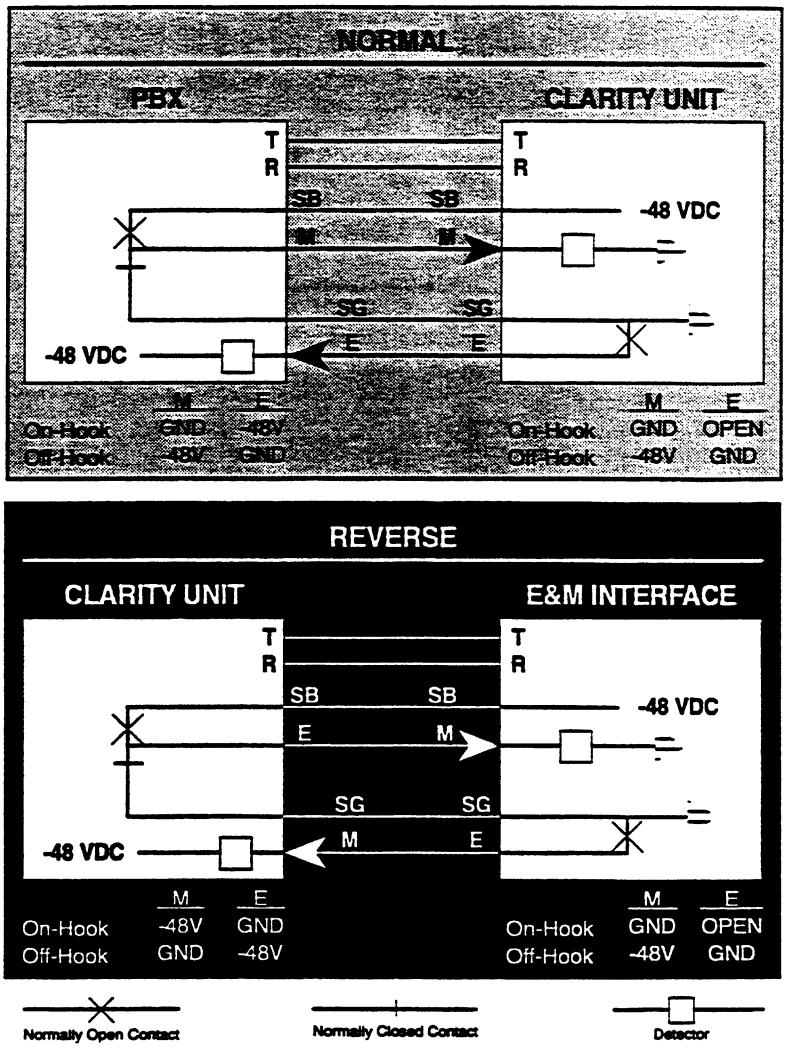


Figure D-6. Type 3, 2-Wire E & M

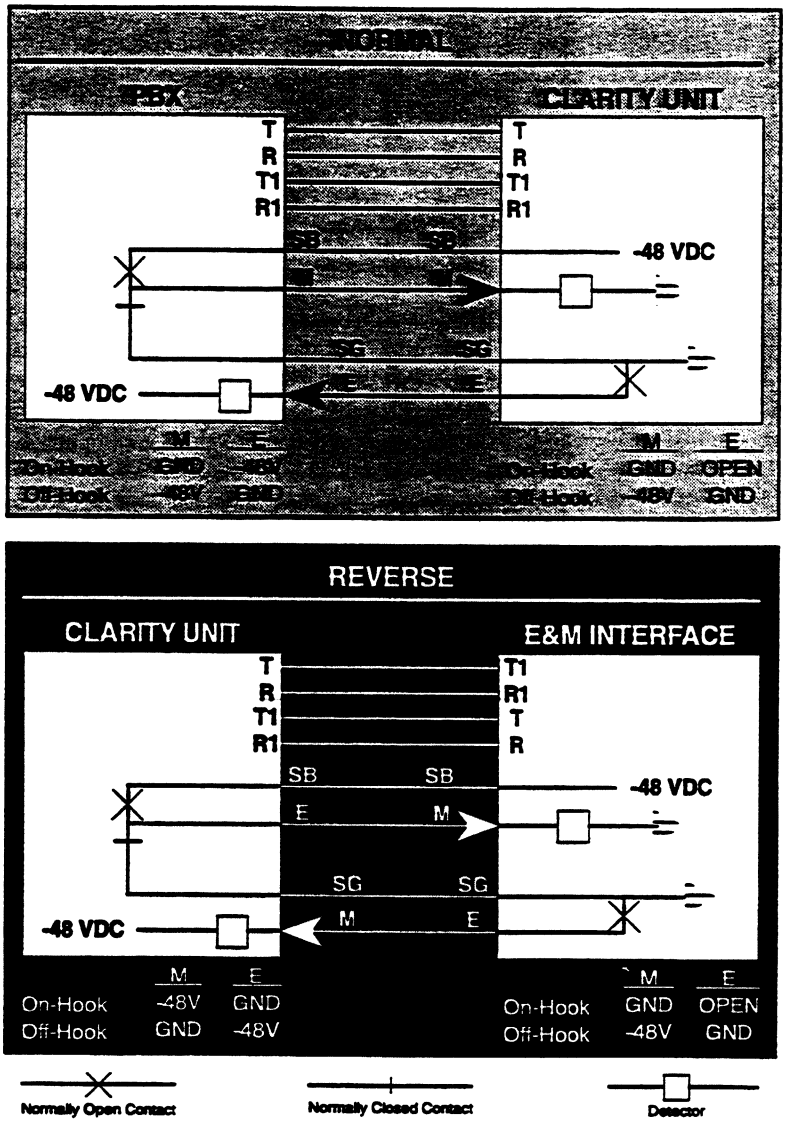


Figure D-7. Type 3, 4-Wire E & M

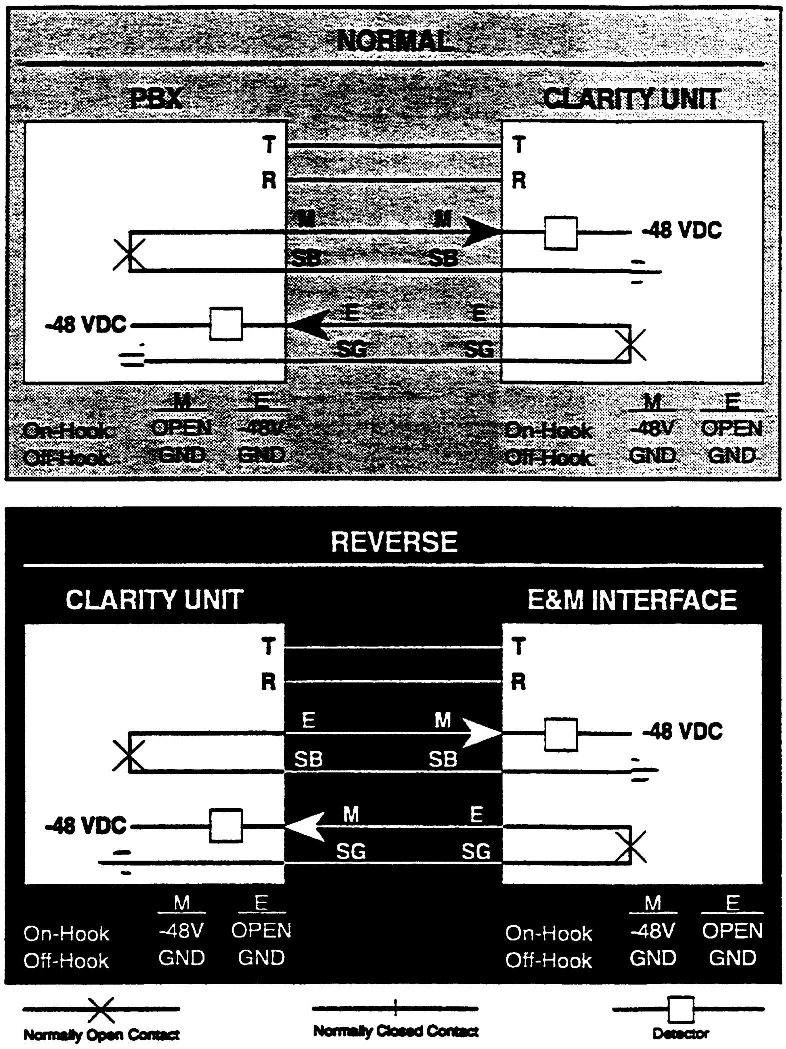


Figure D-8. Type 4, 2-Wire E & M

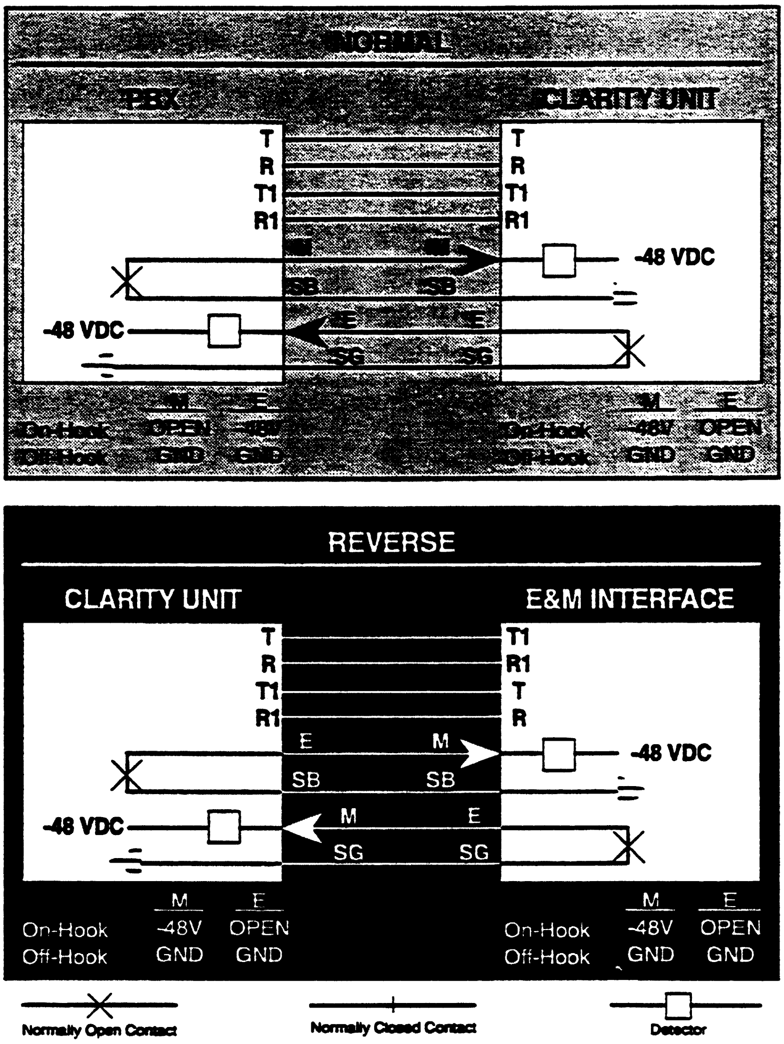


Figure D-9. Type 4, 4-Wire E & M

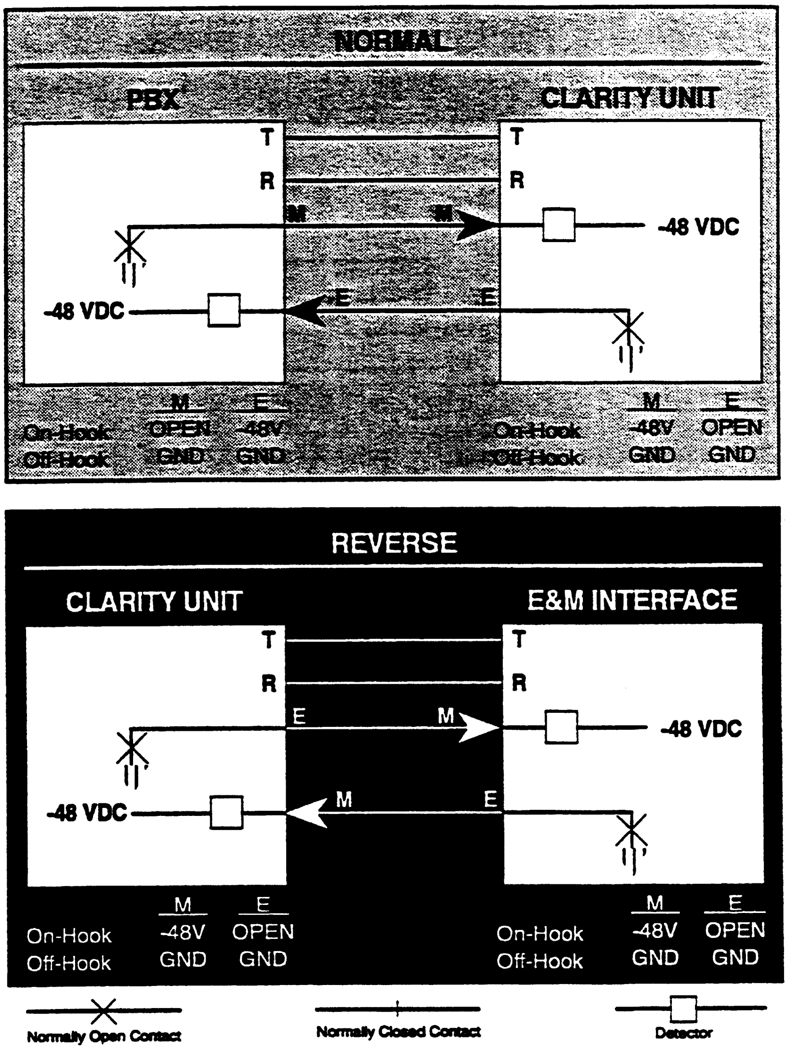


Figure D-10. Type 5, 2-Wire E & M

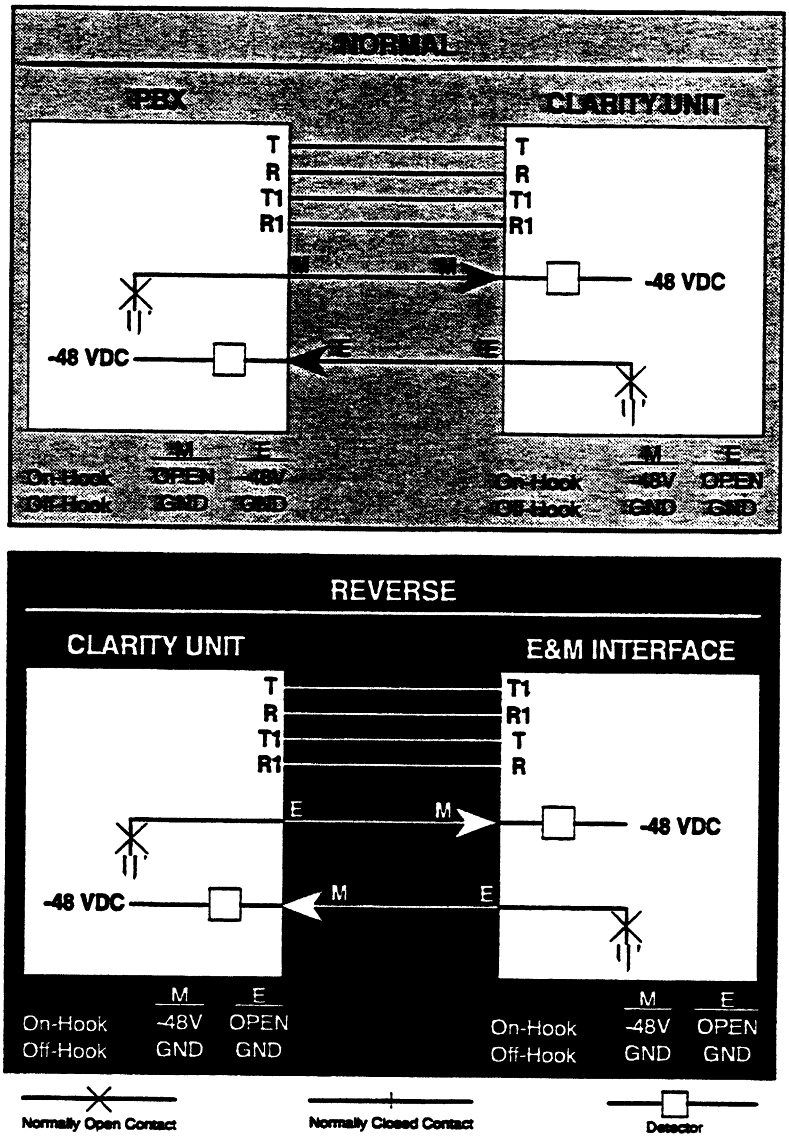


Figure D-11. Type 5, 4-Wire E & M

INTRODUCTION TO LCD INSTALLATION

M. Leiva, T. Sypold, B. Wernek

Revised July 10, 1996

(This document replaces the "Introduction to LCD Installation" section contained in the LCD Manual)

Introduction To Local Control Device (LCD)

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5 August, 1996

The LCD (Local Control Device) is built on a standard IBM PC compatible platform which runs specially developed M&C application software to be used in monitoring and controlling VSAT equipment in Orion customer networks. The LCDs are controlled by, and report alarms to, PC work stations located at the Orion NMC in Rockville and Stevenage. The PC workstations run on the same software as the LCDs themselves. The only difference is that the workstations are higher performance machines with more disk storage for maintaining records of all site configurations. The only distinction we can make between an LCD and a NMC workstation is that one is local to the managed devices and one is usually at the termination point of alarm messages. From this; it can be concluded that the LCD and PC work stations operate in a client to client relationship as opposed to a client server relationship (operating in a client server configuration with a common data base is being considered for near term development of the LCD System).

1.) Application Software Functions

The Application Software which runs on the LCD is called I-MACS (Internetwork Monitor and Control System). The main functions of I-MACS are: 1) Pole co-located communications equipment for current status 2) determine if the current status is an alarm condition and if alarm reporting is required 3) determine the route or routes to use in reporting alarms 4) deliver messages to one or multiple termination points (other LCDs or work stations running I-MACS software) reliably.

Managed networking equipment is communicated with by I-MACS in that equipment's native M&C format. This portion of the software is called a device driver. Currently the Software Vendor (INBAND Corporation) has written driver support for the following equipment: SM2800; SM2900; CM701; CS8000; SSE Radios and various other networking equipment. The LCD will also be able to communicate with ASCII terminal equipment in a pass through mode. Orion shall have the option to write its own device drivers (we have been given this software module's source code in "C" language) or we can pay the manufacturer to do this for us. I-MACS also provides an organized method of configuring physical comm. port interface parameters which allows the full range of configurations that may be required to interface with managed devices.

I-MACS can be configured to filter alarms locally and will not send out messages reporting specific alarm conditions which have been filtered by the NMC. These alarms however are stored in an alarm log file on hard disk locally. NMC controllers can request a down load of this file to examine site statistics. The size of the log file is defined by the NMC and the memory is managed as a circular buffer, discarding the oldest information when memory space runs out. Like the Log file, all other information and configuration parameters are stored in DOS files which can be Down loaded by any other LCD or the NMC work station, modified, and uploaded back to the source LCD if the proper password is provided. This in fact is the method used to check a site configuration and change it if necessary.

I-MACS allows for single or multiple paths for alarm messages to be routed. This is configured by the NMC. Each path has a configurable time out associated with it. If the time out expires another path can be selected or the same path can be selected again after some waiting period. The LCD will continue to try to deliver its messages until it receives an acknowledgment from the receiving station or all time outs have expired. If unable to deliver the message, the LCD will log the failed attempt. Messages can be routed to one termination point directly, they can route to one termination point relayed through other LCDs, or they can route to multiple termination points. A termination point is defined as a PC terminal running I-MACS S/W which accepts a message and acts on them by logging it and sounding an alarm. An LCD relaying the message does not act on that message .

The NMCs are currently set up as multiple termination points for M&C activity. Each LCD will route alarm messages or change of state messages to one of the work stations in Rockville, the work station receiving the message is configured to route this message to another work station and so on until all work stations in the NMC network have the same information. An acknowledged alarm by one of the work stations also gets relayed to all the work stations configured to receive messages. when an alarm is cleared at the originating LCD, another message is relayed indicating this in the same fashion. In this manner, all work stations are alerted with the same information and record the activity in their log file. Note however, that site configuration changes by one work station are not automatically transferred to other work stations. These changes must be manually maintained, controlled, and downloaded to the data bases of other work stations. It is recommended that a process be put in place to manage this type of activity. Likewise, when a new site is created, the site configuration files or drawing files for that site must be down loaded to the other NMS workstations to enable those work stations to act on messages received from the new site.

2.) LCD S/W and H/W Configuration

The LCD is an IBM compatible 486 PC running on a windows 95™ operating system. The current hardware and software configuration is listed below. Note that this may change with new and / or cheaper technology.

Hardware configuration:

- 486 / 66Mhz (min.) with DOS version 6.xx
- 8M RAM 70ns access (using 2 X 4M SIMs)
- VGA interface /w 512KB (min.) video memory

- 400MB (min.) hard Drive / w 12 ms (max.) access time and spin down for idle operation
- Two (2) serial RS-232 communications ports and 2 RS-232 or RS-485 (jumper configurable) Comm. ports. All Comm. ports have 9 pin "D" connectors.
- 3 ½" 1.44MB floppy "A" drive
- Parallel printer port (25 D connector)
- One isolated input and relay output interface card by Computer Boards, Inc.; model # lCIO-PDISO8. This card provides a 37 D connector which shall be secured to the rear panel of the LCD
- IEC type power connection with integrated fuse and power switch located at rear panel.
- Auto-ranging power supply 110 to 230 VAC, 50-60Hz. The power supply shall be 50% (min.) de-rated.
- Forced air cooling fan to provide adequate cooling per environmental requirements
- Hard drive activity indicator light on front panel
- Buss mouse connector (6 position mini DIN)
- Keyboard connector (6 position mini DIN)
- VGA connector (15 position high density "D")
- "Watch dog" timer board
- Rear panel silk screen for all connector labels with epoxy base black paint: mouse, keyboard, comm. 1, etc.
- Power indicator light on front panel

Software Configuration

- Microsoft Windows "95" Software with Orion specified configuration parameters for comm. ports and networking. (this is the operating system which I-MACS runs on. The specific configuration refers to changes in the win.ini file which allows I-MACS to operate in the desired mode for Orion use)

- I-MACS Windows based application software (Provided by INBAND Corporation)

- Net Manage Chameleon software version 4.5 TCP/IP stack (this commercially available S/W is used by I-MACS to provide socket connections for data transfer between its software modules. The need for this S/W will be dispensed with in the third quarter of 1996 by a new version of I-MACS S/W).

- SAM software Provided by INBAND. (this S/W is used to test the watchdog timer card in the LCD. Running SAM.EXE causes the application program to lock up artificially. If the watchdog timer is working, it will re-boot the PC within 20 seconds).

3.) LCD Physical Interface Configurations

Figure 1 shows the rear panel of the LCD which contains all of its physical interfaces. Note that the physical appearance of the rear panel may change with a new generation of PC. The LCD is configured at Orion's LCD System Integrator with standard PC interfaces consisting of a mouse, keyboard, printer port, and VGA port. These interfaces are not used (except at the NMC work stations) for normal LCD operation. The interfaces for managing attached devices and reporting alarms are: 4 COM ports (COM1 through COM 4) all which are RS-232 interfaces with the exception of COM4 which is RS-485; and a contact closure I/O port CIO1, which has 8 contact closure sensors, seven output relays and a +12VDC source. The LCD is optionally configurable for an additional 4 RS-232 ports or 8,16,24,or, 32 additional COM ports of which each group of 8 can be RS-232 or RS-485. The Watchdog timer card contains a D25P connector for the purpose of monitoring and configuring the timer, however serves as no benefit for normal LCD operation.

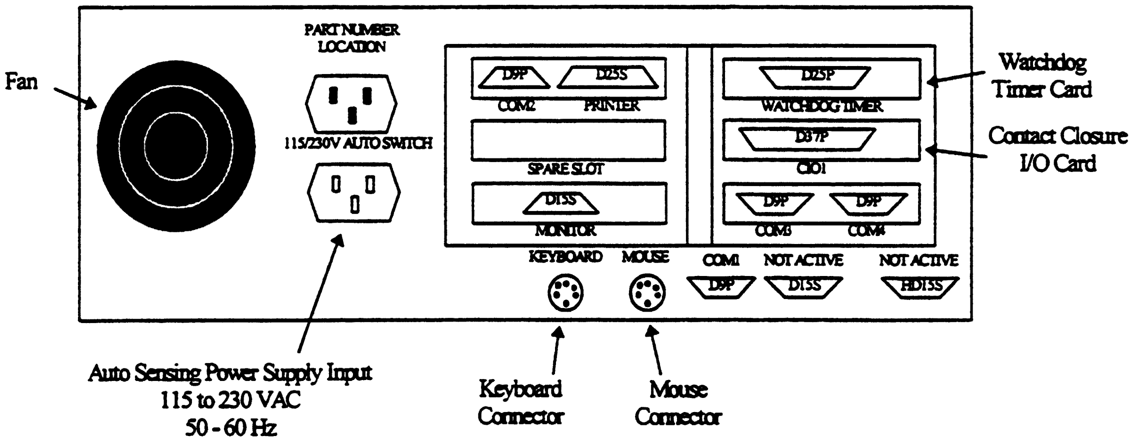
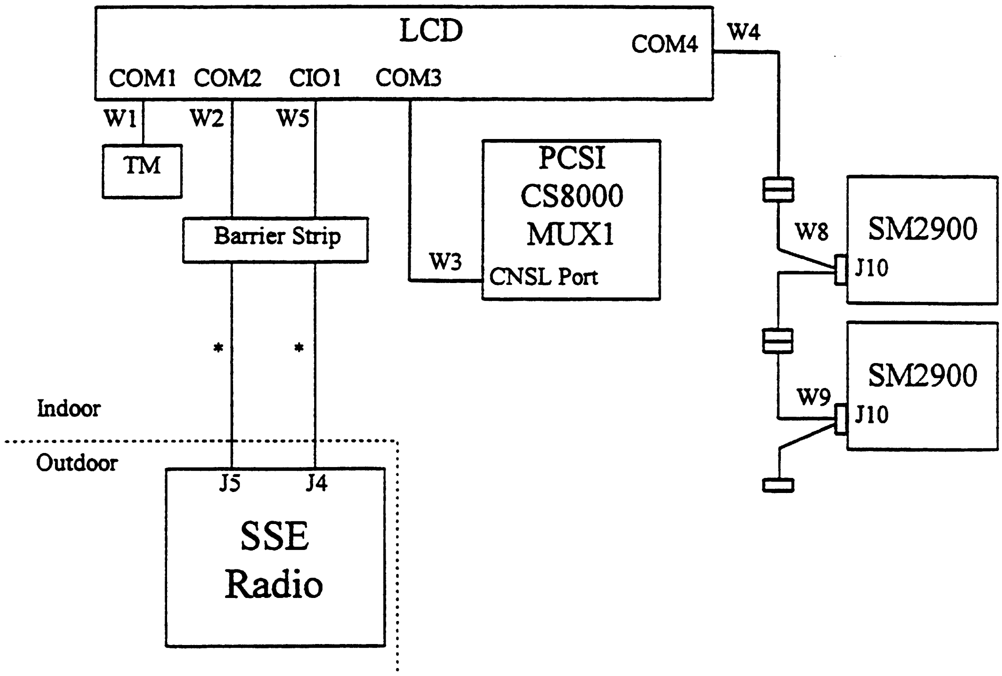


Figure 1: Typical LCD Backpanel

4.) *LCD Operating Environment*

LCDs manage devices and communicate with other LCDs or NMC work stations through RS-232 or RS-485 physical connections. The LCD presents a DTE interface. Either a standard DCE / DTE cable is used for connecting to a DCE device such as a PSTN modem or a null modem cable for connection to another DTE port is used. The other interfaces are contact closure sense inputs or relay activation control outputs. The sense inputs are individually configured by the NMC in the I-MACS S/W to represent specific definable status summary faults for SSE radios, UPSs, or other equipment which provides contact closure status indications. When a contact closure is detected, the LCD, if so configured, will report an alarm with specific information on alarm type and device type, as configured by the NMC for that contact closure input. Output relay closures are controlled in real time by the NMC and can be used to activate devices such as door latches and baseball switches. Figure 5 shows the pinout of the contact closure connector CIO1. Figures 2 through 4 show typical LCD connection configurations and Table 5 shows the cable part numbers required.

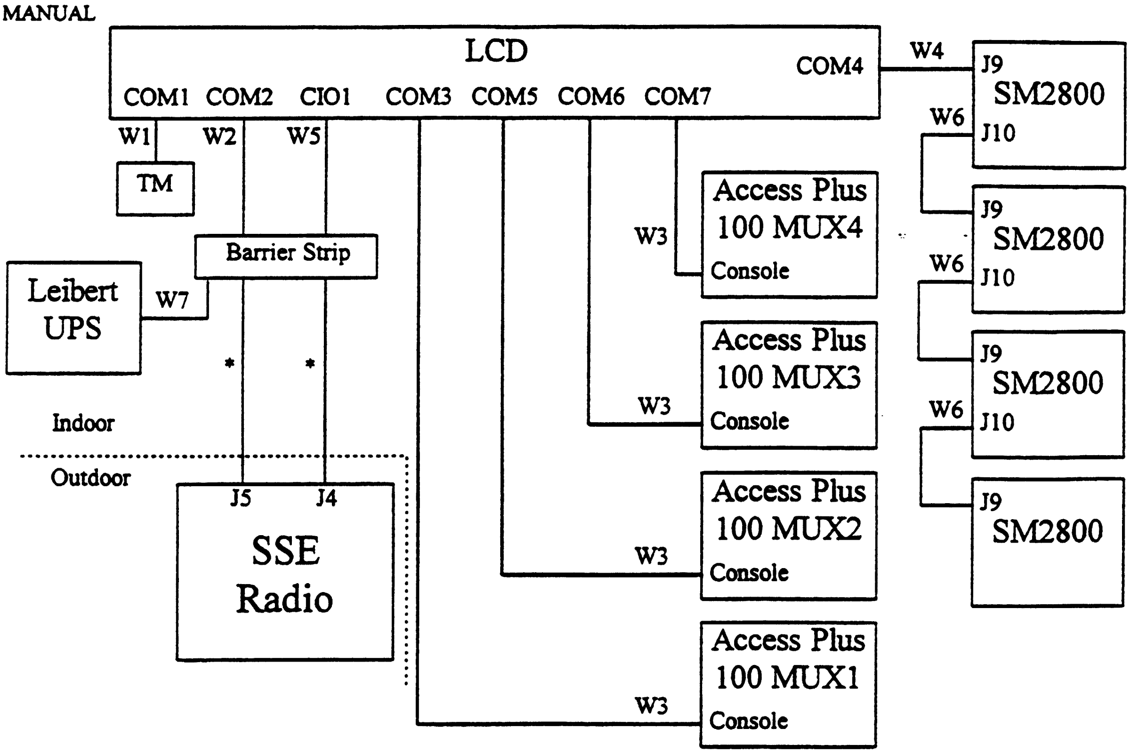
Figure 2 shows a typical operating configuration of an LCD managing two Fairchild SM2900s and a PCSI CS8000 Multiplexer. The device driver module in the I-MACS S/W polls each device in its native M&C format for alarm statistics and detects the occurrence of such alarms. The main communications path used for communicating to the NMC is through a PSTN modem attached to COM1 on the LCD.



* These cables are assembled in the field by the ground operators.

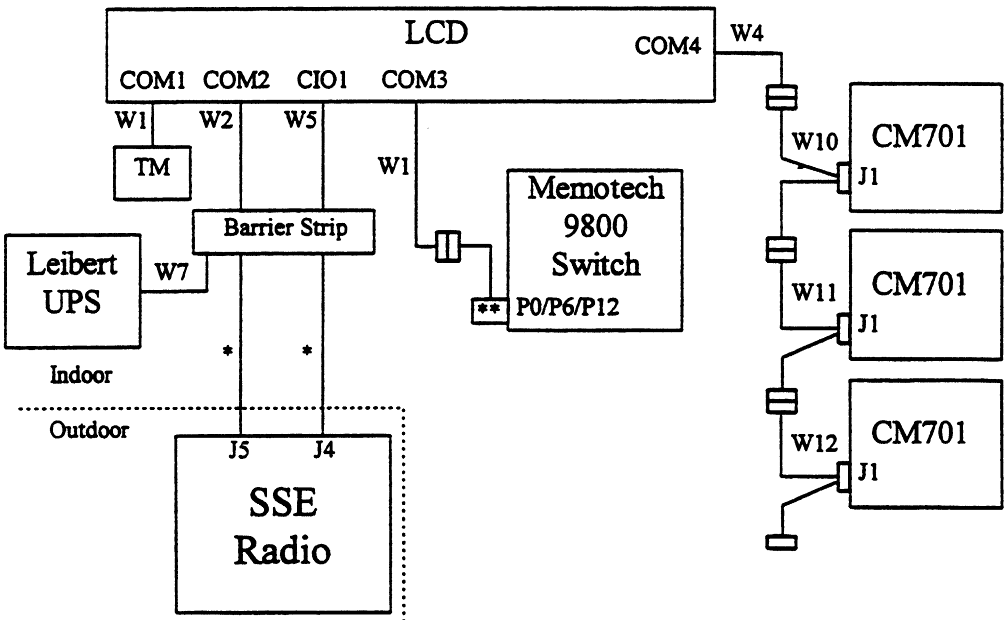
Figure 2: Typical LCD configuration incorporating SM2900s, a SSE radio and a CS8000 multiplexer

Figure 3 shows an LCD managing four Access Plus 100 multiplexers, four SM2800s, a SSE radio and an UPS. Note that the SSE radio is being managed in 2 ways. It is being polled for alarms by the I-MACS device drivers and it is being monitored for contact closure summary faults. The UPS is being monitored for contact closure summary faults only. All SM2800s are being managed through one RS-485 connection which is daisy chained to each modem.



* These cables are assembled in the field by the ground operators.

Figure 3: Typcial LCD configuration incorporating Access Plus multiplexers, SM2800s, a SSE radio and an UPS.



* These cables are assembled in the field by the ground operators.
** Memotech cable adapter, Memotech Part Number 60300037.

Figure 4: Typical LCD configuration incorporating CM701s, a Memotech 9800, a SSE radio and an UPS

Another example of a typical LCD configuration is illustrated in Figure 4. This configuration includes three CM701 modems, a SSE radio, an UPS and a Memotech 9800 frame relay switch. The CM701 modems and the SSE radio are polled for alarms and status. The SSE radio and the UPS have alarm contact closures which are monitored by the LCD. The frame relay switch is accessed using a terminal mode which is part of the IMACS software.

5.) LCD Modifications to the Field Installation Manuals

It will be necessary to incorporate the LCDs in the Field Installation Manuals. This involves changes to the rack cabling diagrams, cable run lists, equipment lists, configuration sheets and test procedures. Examples of these documents are contained in the Appendix for the Terminal Bar Cafe in Prague and GTS Budapest in Budapest. Use these as references when creating FIMs.

The existing rack cabling diagrams can be used with the LCDs. The only changes which need to be made are the substitution of the LCD in place of the LCP. A standard connection scheme has been adopted and is listed in Table 1. Refer to Appendix A for illustration of typical rack cabling diagrams.

LCD Port	Interface	Device Connected
COM1	RS-232	PSTN Modem
COM2	RS-232	SSE Radio or equivalent
COM3	RS-232	Access Plus 100, PCSI CS8000 multiplexer, Memotech 9800 switch or equivalent
COM4	RS-485	CM701, SM2800, SM2900 modems or equivalent
COM5-8	RS-232	Any serial device

Table 1: LCD port connection scheme

A number of new cables have been designed for use with the LCD and are listed in Table 2. These new cables incorporate the new cable numbering system and there are no letter designators. Use these numbers to reference these cables in the cable run list. For older cables used with the LCD, use the new cable number but include a reference to the old cable letter designator/part number.

The LCD has been assigned an Orion part number which must be included in the equipment list for each of the sites. The part number is defined as follows;

LCD Part Number = "LCD1-X -SS-I"

Where;

LCD1 = IMACS computer designator revision 1. Future revisions are indicated by the number following "LCD" (ie. LCD2, LCD3, etc).

X = "R" for remote or "M" for master. These values were included in the part number since we are currently using Pentium PCs for the master nodes and 486 PCs for the remote nodes. A standard configuration for the master and remotes shall be defined so that logistics will know what to order in the future.

SS = Number of serial ports, 00-99 (two digit code)

I = Number of I/O ports, 0-9 (the number of I/O ports (boards installed) not the number of individual contact closures, 1 digit code)

The base configuration for the LCD at the remote sites includes four serial ports and one I/O port. Therefore the part number for the LCD which should be used in the equipment list is "LCD1-R-04-1". If there is a site configuration which requires more than four serial ports (i.e. Figure 3), then it will be necessary to install additional "Moxa" serial boards in the LCD. The base unit "Moxa" board contains four serial ports. So if five serial ports are needed for a given remote installation, the LCD part number is "LCD1-R-08-1". This same part number will be used for all sites which require anywhere from five to eight serial ports.

The configuration sheet used with the LCDs is shown in the Appendix. The configuration sheet includes references to the site code, host name and S/W Rev. The site code is defined by Rick Jeffery and is contained in the "intgstat.xls" file located on the P drive in the "\oa_netsv\logistic\integrtn\" directory. Use the site code for the host name. The S/W Rev number will be defined by M. Leiva and will be made available in a TBD location on the P drive.

The other areas of the LCD configuration sheet include "Telephone Modem Phone Numbers", "RS232 Serial Port Configurations", "RS485 Serial Bus Configurations" and "Alarm/Control Point Assignments".

The "Telephone Modem Phone Numbers" section contains "Port No.", "Type Modem" and "Phone Number" fields. In the case of the remote LCDs, the "Port No." is always "COM1" and the "Type Modem" is always "PSTN Modem". The "Phone No." is "001-301-670-6586" but this number does not include any prefix numbers which may be necessary to get an outside line. For example, "9" is the prefix number used to get an outside line at the Orion headquarters in Rockville and would need to be part of the "Phone No." field if it were applicable.

The "RS232 Serial Port Configurations" section is used to define LCD connections to serial devices. The "Port No." field refers to the LCD port to which the device being controlled/monitored is connected. The "Port No." can be anywhere from COM2 to COM8. Note that the PSTN modem is always COM1. The "Device Description" field contains the name of the device (SM2800, SM2900, CM701, etc). The "Device Designator" field contains the name of the device as referenced on the site diagram located on the LCD master at the NMC. The naming convention has been standardized and is listed in Table 2. The "Number 1 - N" refers to the number of the modem, multiplexer, switch, etc.

Device Description	Device Name
SM2800, SM2900, CM701 Number 1 - N	Modem 1 - N
Access Plus 100, CS8000 Number 1 - N	Mux 1 - N
Memotech 9800 Number 1 - N	Switch 1 - N
SSE Radio, Skydata Radio Number 1 - N	Radio 1 - N

Table 2: Device Naming Convention

The "Baud Rate", "Bits", "Parity" and "Stop" fields contain the information needed to establish a serial link. The values in these fields had been standardized and is listed in Table 3.

Device Description	Baud Rate	Bits	Parity	Stop
SM2800, SM2900, CM701	9600	8	None	1
Access Plus 100, CS8000	9600	8	None	1
Memotech 9800	9600	8	None	1
SSE Radio	1200	7	Odd	1

Table 3: Standard Device Serial Link Parameters

The "RS485 Serial Bus Configurations" section lists the parameters associated with RS485 type devices. The "Address" field can be any value from 1 to 20 and starts sequentially at 1 for each device listed. The "Device Description" and "Device Designator" fields are the same as those listed in the "RS232 Serial Port Configurations" section. The "Distant End" field specifies the city, state and country of the other end of the satellite link. The values used in the "Baud Rate", "Bits", "Parity" and "Stop" fields are listed in Table 3.

The "Alarm/Control Point Assignments" section lists the contact closure alarms and the related I/O points on the CIO1 port. The "I/O Board Points/Pins" field lists the CIO1 port inputs for a given contact closure. The "Alarm/Control Point Description" field is a description of the alarm and the related device. The "Alarm/Control Point Designator" field is the designator used at the NMC for a given alarm and device. The "Type Contact" field can be either "Latching" or "Non-latching" indicates that on alarm the relay will latch until the alarm is reset or not latch. The "Alarm Condition" field can be either "Open" or "Closed" and indicates that on alarm the relay is either open or closed. Additional, contact alarms will be added in the future as needed. Table 4 lists the standard "I/O Board Points/Pins" configuration for the UPS and SSE radio.

I/O Board Points	Alarm/Control Point Description	Alarm/Control Point Designator	Type of Contact	Alarm Condition
Input 0	UPS Input Power Failure	AC Power Failure	Latching	Closed
Input 1	UPS Low	UPS Low	Latching	Closed

	Battery	Battery		
Input 2	SSE Radio TX Alarm	Radio TX Alarm	Latching	Closed
Input 3	SSE Radio RX Alarm	Radio RX Alarm	Latching	Closed

Table 4: Standard I/O Board Points Configuration

Test procedures for the LCD have been written for point to point links and point to point links which include a multiplexer. These test procedures are contained in the "pt2ptstd.doc" and "p2pmux.doc" files located in the \cntrldocs\fimaster\tests directory on the P drive.

6.) LCD Recommended Site Installation Procedure

LCDs will be shipped to site with all required H/W and S/W. What remains is to provide the site configuration information. This will be provided by the NMC. When the LCD is powered on, it is configured to automatically boot the operation and application software. COM1 will be ready to accept commands from the NMC via a PSTN modem connection. Once the NMC has established connection and downloaded the site configuration information, it will send a reset command which will re boot the LCD. When the LCD has booted, it will be operating with the new site configuration. At this time testing can take place for M&C functionality.

An alternative method of configuring a LCD is to load a pre prepared diskette into the "A" drive. Upon power up, the LCD should boot off of drive "A". When the boot up is complete the LCD will be in operation. the Diskette can now be removed. It is recommended that ground operators archive a diskette containing each LCD site configuration in their service domain.

Note that no monitor, mouse, or keyboard should be required to complete a successful LCD installation.

Table 5: LCD Cable List

Cable No.	Old P/N	Cable P/N	From LCD, Port	To Device, Port	Comments
W1	AA	00F/02M-08U-01-XXF	COM1	PSTN Modem or Memotech 9800 P0/P6/P12	Designed/Tested, T. Sypolt
W2	EE	00F/97X-3U-01-XXF	COM2	Barrier Strip	Designed/Tested, T. Sypolt
W3	BB	00F/00F-05U-01-XXF	COM3	PCSI	Designed/Tested, T. Sypolt

				Multiplexer, Console Port	
W4	None	00M/00F-05B-17-XXF	COM4	SM2800, J9 or W8 (SM2900 J10)	Designed/Tested, T. S New installations
W5	None	03F/97X-05C-01-XXF	CIO1	Barrier Strip	Designed, J. Olmsted
W6	TT	00M/00M-09U-06-XXF	SM2800, J9	SM2800, J10	
W7	None	02M/97X-03C-02-2.5F	UPS Alarm Port	Barrier Strip	Designed, J. Olmsted
W8	TT-2	00M/02M/00F-05B-18-01F	SM2900 J10	W4 and W9	Designed, J. Olmsted
W9	TT-2	00M/02M/00F-05B-18-01F	SM2900 J10	W8	Designed, J. Olmsted
W10	None	To Be Determined	CM701 J1	W4 and W11	Being designed by R.
W11	None	To Be Determined	CM701 J1	W10 and W12	Being designed by R.
W12	None	To Be Determined	CM701 J1	W11	Being designed by R.

6.) LCD System Advantages

A.) Off the shelf hardware available from multiple vendors which is an industry standard

B.) Many commercially available hardware components for system flexibility and performance enhancements, such as; comm. ports, A/D conversion cards, test and measurement cards, memory, etc. which could enable Orion to use the system in new and innovative ways.

C.) Numerous commercially available S/W products compatible with PC / Windows platform for future system flexibility and performance enhancements

D.) I-MACS application S/W is very flexible in allowing operator to: program timers and port configurations, trouble shoot system, assign variable names, select and display viewing formats, sort data lists, etc.

E.) IMAC S/W vendor (INBAND) provides avenue to allow Orion the option of programming its own new device drivers or modify old ones

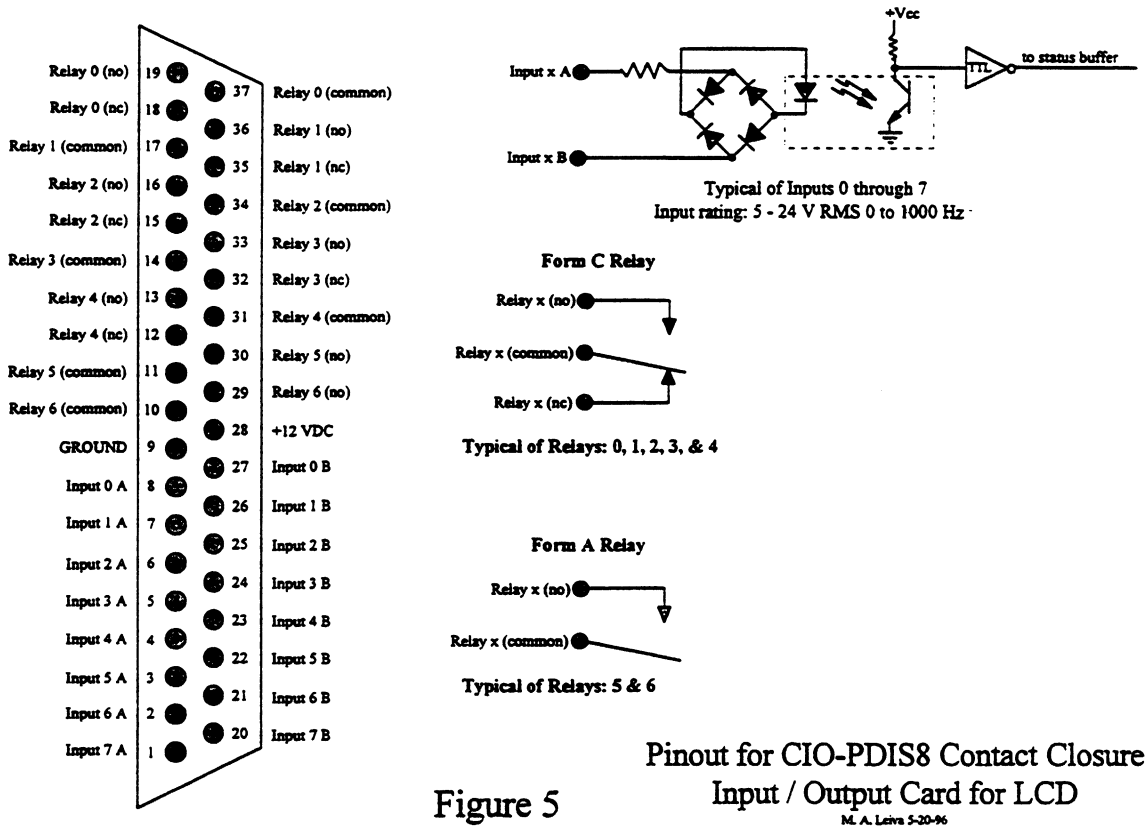


Figure 5

Pinout for CIO-PDIS8 Contact Closure Input / Output Card for LCD
M. A. Leiva 5-20-96

7.) LCD System disadvantages

A.) Rapidly changing H/W platform due to new technology can present sparing, logistics, and configuration management problems if not managed properly

B.) I-MACS S/W and PC flexibility and expandability also translates into system complexity which requires more training and PC proficiency by user for proper system implementation.

APPENDIX

Cable Run List

GTS - Budapest
Rev. 0.1, 01 July 96
J. Close/Ronnie Jones

Cable #	From Device, Port	To Device, Port	Type/	Length
W 1	Radio, M&C	Outdoor SLP	33M/97X-08B-01-XXF (AR-3)	/6 Note1
W 2	Radio, Alarm	Outdoor SLP	30F/97X-04C-01-XXF (AR)	/6 Note1
W 3	SLP/Jack2	Barrier strip	Note 2	
W 4	Radio, IF IN	Sat Modem, J2 Tx	RG-11	200
W 5	Radio, IF OUT	2 Way Div., C	RG-11	200
W 6	Sat.Modem, J1 Rx	2 Way Div., 1	41M/41M-01I-01-XXF (UU)	4
W 7	RJ11 Jack 2	Barrier Strip	Note 3	
W 8	RJ11 Jack 2	PSTN Modem, Telset	Note 5	
W 9	LCD, CIO1	Barrier Strip	03F/97X-05C-01-XXF	6
W 10	LCD, COM2	Barrier Strip	00F/97X-03U-01-06F (EE)	6
W 11	Customer Equip	Sat. Modem, J3	Note 4	
W 12	LCD, COM4	Sat Modem, J9	00M/00F-05B-17-XXF	6
W 13	LCD, COM1	PSTN Modem, DTE	00F/02M-08U-01-XXF (AA)	
W 14	Optional UPS Alarm	Barrier Strip	02M/97X-03C-02-2.5F	
W 15	RJ11 Jack 1	PSTN Modem, Telco	Note 5	
W 16	RJ11 Jack 1	DID Line from Customer	Note 6	

Note 1: Cable W1 and W2 Ground Operator to build in field per cable spec.
Note 2: 6 Pair M&C cable, Olympic wire & cable P/N 9604
Note 3: Two pair telco station wire. RJ11 Jack 2 allows a technician to connect a phone at the antenna during maintenance calls provided W7 is connected.
Note 4: Customer provided cable.
Note 5: RJ11 to RJ11 cable,
Note 6: Customer provided single pair cable with bare copper for screw down lugs in RJ11 Jack.

Equipment List

Please record the Serial Numbers in the spaces provided.
GTS - Budapest
Rev. 0.1 July 01,1996
Jerry Close/ Ronnie Jones

Item	Part No.	Description	Vendor	Qty	Serial No. (Fill in)
1	1244-993/ 0800-1451	Antenna, 2.4m,4 piece unit, w/de-ice with Interface, 2.4m Boom , 4 Piece OMT, SSE	Prodelin	1	
2	VL-10	Antenna mount (non-pen, etc.) based on site survey results.	Baird	1	
5	S1214-A24333	SSE 2 Watt, S-line Ku band transceiver, 70 Mhz IF fixed Gain dual synthesizer tuning in 1 Mhz steps, 14.25-14.5 Ghz TX, 11.45-11.7 Ghz RX, 110 K LNC, 110-230 VAC,/50-60 Hz, with M&C	SSE	1	
6	344-042251-001	SSE mouting kit for Txcr on 2.4m Prodelin antenna with co-pol feed, including flexible waveguide.	SSE	1	
7	SM2800 -STD-V35	SM2800 satellite modem, V.35 Interface, 70 MHz, 64 Kbps, sequential decoder	Fairchild	1	
8	LCD1-R -04-1	Remote LCD with 4 serial ports and 1 I/O port.	IMACS	1	
9		PSTN Modem , Motorola UDS, or equivalent	Ground operator needs to provide modem	1	
10	SP320A	SLP, Surge Protector, RS-232, 6 wire	Black Box	1	
11		Power Divider, 2-way, 0 deg, 70 Mhz, 75 ohm	MiniCkts	1	
12		Attenuators,6dB,10dB,15dB,20 dB	MiniCkts	1 Each	
13		Cables per Cable Run List		1 lot	

* No UPS provided by Orion

IMACS/LCD Configuration Sheet

Site Name:	Budapest	Date:	07/01/96
Site Location:	Budapest, Hungary	Rev. No.	0.00
Site Code:	GTS-VACHNGL1	Proj Engr:	J. Close
Customer:	GTS	Host Name:	GTS-VACHNGL1
		S/W Rev.	3.00.12

Telephone Modem Phone Numbers

Port No.	Type Modem	Phone No:
COM1	Telephone Modem	001-301-670-6586

RS232 Serial Port Configurations:

Port No.	Device Description	Device Designator	Data			
			Baud Rate	Bits	Parity	Stop
COM1	Telephone Modem		9600	8	None	1
COM2	SSE Radio	Radio	1200	7	Odd	1

RS485 Serial Bus Configurations
Via Port: COM4

Address	Device Description	Distant End	Device Designator	Data			
				Baud Rate	Bits	Parity	Stop
1	Fairchild SM2800	McClean, VA	Modem1	9600	8	None	1

Alarm/Control Point Assignments
Via Port: CIO1

I/O Board Points	Alarm/Control Point Description	Alarm/Control Point Designator	Type Contact	Alarm Condition
Input 0				
Input 1				
Input 2	SSE Radio TX Alarm	Radio TX Alarm	Latching	Closed
Input 3	SSE Radio RX Alarm	Radio RX Alarm	Latching	Closed

FIMForm 1, Rev. 3, June 21, 1996

Equipment List

Please record the Serial Numbers in the spaces provided.
Terminal Bar Internet Cafe - Prague
Rev. 0.1, 02 July 96
Jerry Close/ Ronnie Jones

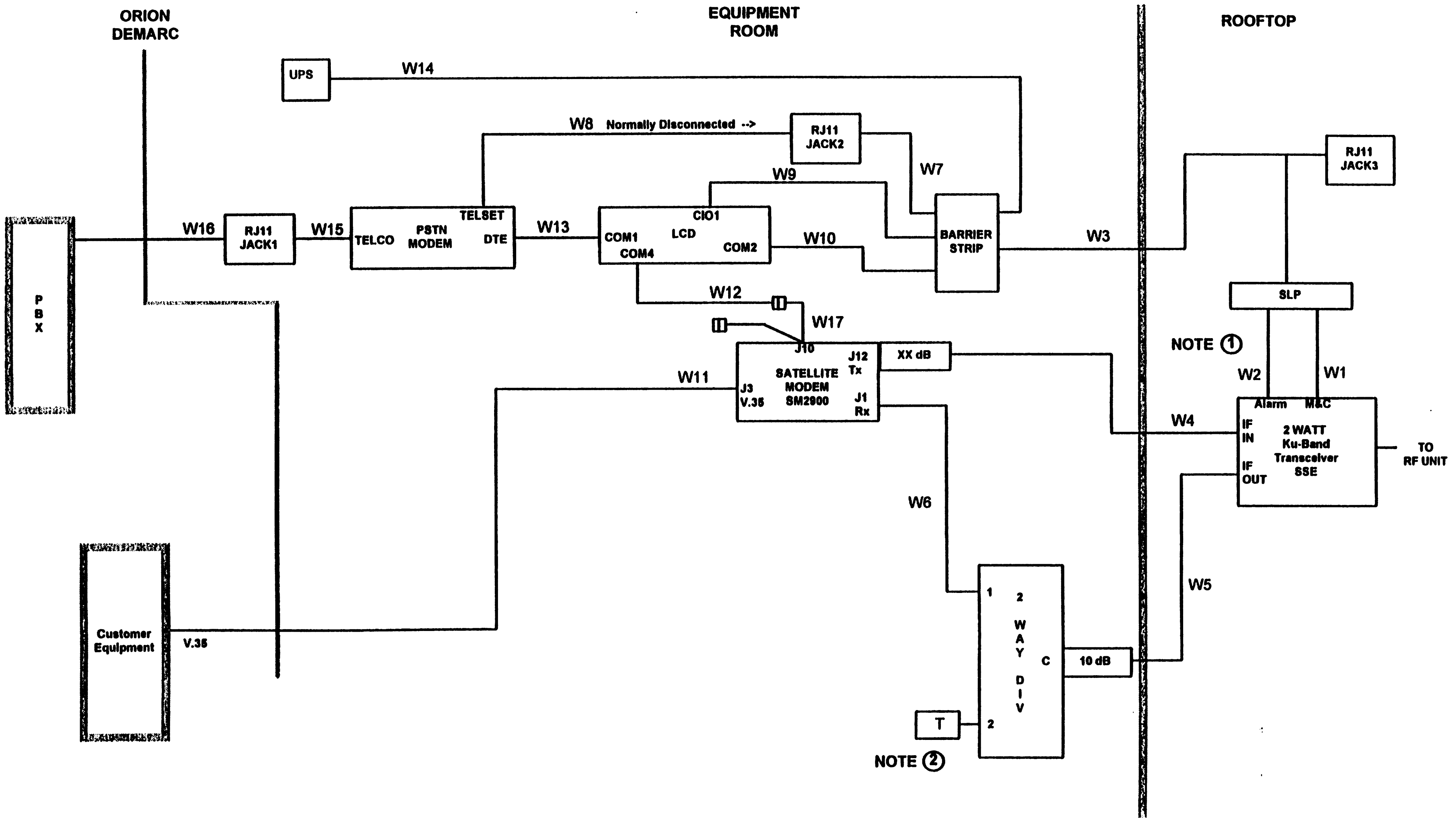
Item	Part No.	Description	Vendor	Qty	Serial No. (Fill in)
1	1244-373	2.4m Ku Band RX/TX antenna, (4 Piece), ETSI compliant SSE Interface, including OMT Electrical Anti-Icing for 4 piece 2.4m Antenna with Antenna mount (non-pen, etc.) based on site survey results	Prodelin	1	
2	S1214-A24333	SSE 2 Watt, S-line Ku band transceiver, 70 Mhz IF fixed Gain dual synthesizer tuning in 1 Mhz steps, PanAmSat Band 14.-14.5 Ghz TX, 11.45-11.95 Ghz RX, 110 K LNC, 110/220 VAC,/ 50/60 Hz, with M&C	SSE	1	
3	344-042251-001	SSE mouting kit for ASAT 2 watt on 2.4m Prodelin antenna including mounting kit for radio and flexible waveguide.	SSE	1	
4	SM2900-Vit	SM2900 satellite modem, 70 MHz, Viterbi decoder, V.35	Fairchild	1	
5	LCD1-R-04-1	Remote LCD with 4 serial ports and 1 I/O port, 230V	IMACS	1	
6		PSTN Modem , Motorola UDS, or equivalent	Provided by Ground Operator	1	
7	ZFSC-2-1-75-B	Power Divider, 70 Mhz, 2 way,	Mini Ckts	1	
8		Barrier Strip, 14 Position		1	
9		Attenuators, 6dB,10dB,15dB,20dB		1 Each	
10	SLP	Surge and Lightning Prot, for Data Lines		1	
11	AU1500 RM	UPS,1500 VA, 220 V, 50 Hz	Emerson	1	
12		Rack, 42 in", with Power Strip, Ground Bar and mounting plate		1	
13		Cables per Cable Run List		1 lot	

Cable Run List

Terminal Bar Internet Cafe - Prague
Rev. 0.1, 01 July 96
J. Close/ Ronnie Jones

Cable #	From Device, Port	To Device, Port	Type/	Length
W 1	Radio, M&C	Outdoor SLP	33M/97X-08B-01-XXF (formerly AR-3)	/6 Note1
W 2	Radio, Alarm	Outdoor SLP	30F/97X-04C-01-XXF (formerly AR)	/6 Note1
W 3	SLP/Jack3	Barrier strip	Note 2	
W 4	Radio, IF IN	Sat Modem, J12 Tx	RG-11	200
W 5	Radio, IF OUT	2 Way Div., C	RG-11	200
W 6	Sat.Modem, J1 Rx	2 Way Div., 1	41M/41M-01I-01-XXF (formerly UU)	4
W 7	Barrier strip	RJ11 Jack 2	Note 3	
W 8	RJ11 Jack 2	PSTN Modem, TELSET	Note 3	
W 9	LCD, CIO1	Barrier Strip	03F/97X-05C-01-XXF	6
W 10	LCD, COM2	Barrier Strip	00F/97X-03U-01-XXF (formerly EE)	6
W 11	Customer Equip	Sat. Modem, J3	Customer Provided	
W 12	LCD, COM4	Cable W17	00M/00F-05B-17-XXF	6
W 13	LCD, COM1	PSTN Modem, DTE	00F/02M-08U-01-XXF (formerly AA)	
W 14	UPS, Alarm	Barrier Strip	02M/97X-03C-02-2.5F	6
W 15	RJ11 Jack 1	PSTN Modem, Telco	Note 5	
W 16	RJ11 Jack 1	DID Line from Customer	Note 6	
W17	SM2900, J10	Cable W12	00M/02M/00F-05B-18-XXF (formerly TT-2)	

Note 1: Cable W1 and W2 Ground Operator to build in field per cable spec.
Note 2: 6 Pair M&C cable, Olympic wire & Cable P/N 9604
Note 3: Two pair telco station wire. RJ11 Jack 3 allows a technician to connect a phone the antenna during maintenance calls provided W8 is connected.
Note 4: Customer provided cable.
Note 5: RJ11 to RJ11 cable
Note 6: Customer provided single pair cable with bare copper for screw down lugs in RJ Jack.

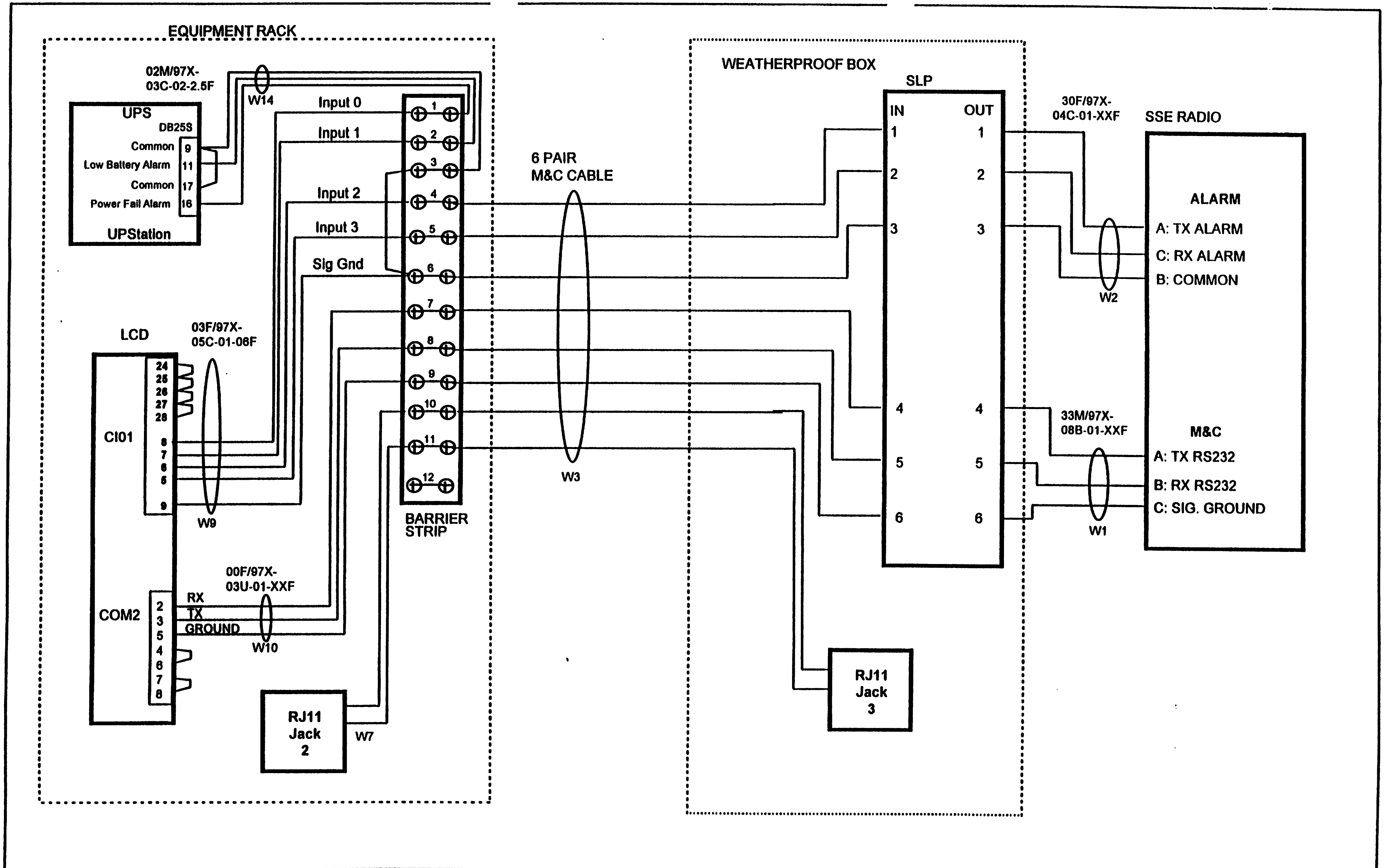


NOTES:

① See Sheet 2 for Wiring Detail, W1 and W2 Assembled In Field

② 75 Ohm BNC terminator

Orion Atlantic	JOB NAME:	Terminal Bar Internet Cafe	DWG. TITLE:	Rack Cabling Diagram
	ENGINEER:	Jerry Close	DWG. NO.	REV. 0.1
	CHECKED BY:	Ronnie Jones	DATE: 28 June 96	SHEET 1 OF 2



Orion Atlantic | JOB NAME: Terminal Bar Internet Cafe | DWG. TITLE: Rack Cabling Diagram

IMACS/LCD Configuration Sheet

Site Name:	Terminal Bar Cafe	Date:	07/01/96
Site Location:	Prague	Rev. No.	0.00
Site Code:	TBI-PRGCZRA1	Proj Engr:	J. Close
Customer:	Terminal Bar Internet Cafe	Host Name:	TBI-PRGCZRA1
		S/W Rev.	3.00.12

Telephone Modem Phone Numbers

Port No.	Type Modem	Phone No:
COM1	Telephone Modem	001-301-670-6586

RS232 Serial Port Configurations:

Port No.	Device Description	Device Designator	Data			
			Baud Rate	Bits	Parity	Stop
COM1	Telephone Modem		9600	8	None	1
COM2	SSE Radio	Radio	1200	7	Odd	1

RS485 Serial Bus Configurations
Via Port: COM4

Address	Device Description	Distant End	Device Designator	Data			
				Baud Rate	Bits	Parity	Stop
1	Fairchild SM2900	Beltsville, MD	Modem1	9600	8	None	1

Alarm/Control Point Assignments
Via Port: CIO1

I/O Board Points/Pins	Alarm/Control Point Description	Alarm/Control Point Designator	Type Contact	Alarm Condition
Input 0	UPS Input Power Failure	AC Power Failure	Latching	Closed
Input 1	UPS Low Battery	UPS Low Battery	Latching	Closed
Input 2	SSE Radio TX Alarm	Radio TX Alarm	Latching	Closed
Input 3	SSE Radio RX Alarm	Radio RX Alarm	Latching	Closed

FIMForm 1, Rev. 3, June 21, 1996

PSTN Modem
Victory 2400 B

Chapter 3

MODEM COMMANDS and REGISTERS

Chapter 4

SYNCHRONOUS OPERATION

Chapter 5

TROUBLESHOOTING

Chapter 1

UNPACKING and INSTALLATION

This chapter describes the unpacking and installation procedures for your modem. For the general modem user with a popular communications software package, this may be the only chapter you shall need.

1.1 Unpacking the Modem

The complete package of your modem includes:

1) The modem unit.
2) This user's manual.
3) An RJ-11 modular phone cable.
4) A power adaptor.
5) Communications software DataTalk™.

Carefully inspect the package for shipping damage. If any is found, immediately repack the modem in the original packing material and contact your dealer.

1.2 LED Indicators

There LED indicators on the front panel of your modem are:

MR Modem Ready. Lights when the modem is turned on. Flashes when the modem is in test mode.

TR Terminal Ready. Lights when the computer or terminal is ready.

CD Carrier Detect. Lights when a remote modem carrier is detected.

SD Send Data. Flashes when the modem is sending data to the remote modem or when receiving data from the local computer.

RD Receive Data. Flashes when the modem is receiving data from the remote modem or when sending data to the local computer.

HS High Speed. Lights during CCITT V.22bis or Bell 212A; off during CCITT V.22, V.21, V.23, or Bell 103.

Flashes when the modem is in dumb mode and ready for V.22bis.

AA Auto Answer. Lights when the modem is set for auto-answer; flashes when an incoming ring is detected.

OH Off-Hook. Lights when the modem is using the telephone line (off-hook); off when the modem is not using the line (on-hook).

1.3 The Rear Panel

The rear panel of modem contains the power switch, the power jack, the RS-232C connector, and two modular jacks.

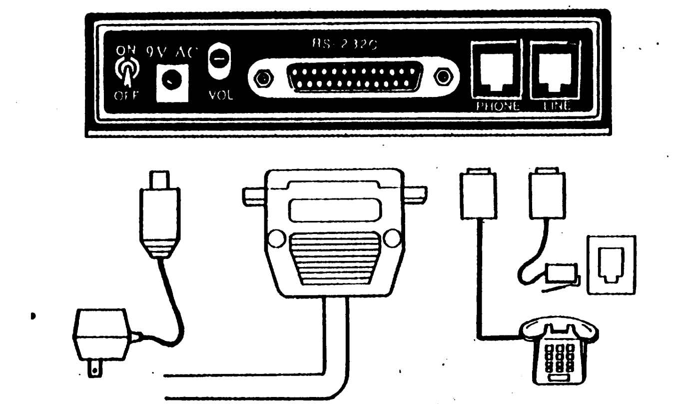


Fig 1-1 The rear panel of the modem

1.4 The Serial Port

Your computer or terminal must have an industry standard RS-232C serial port to use this modem or any other external modem. Ask your dealer to acquire an RS-232C port for your computer if you need one.

Use an appropriate serial cable to connect your modem to your computer's serial port. Be sure to specify the type of connector (DB-25 or DB-9, male or female) at both ends of the cable. Your modem follows industry standards in wiring the pins of the cable connectors. therefore, a cable that can connect a Hayes modem to your computer is compatible. Refer to the Appendix in this manual if you need the pin assignments of the connector.

1.5 Testing the Telephone Line

Be sure that the telephone system and line are in good order before the modem is connected. Test the line by lifting the telephone handset and listening for a clear dial tone. Try placing a few calls. If the calls do not go through well or are not loud and clear, you may have a poor quality telephone line. In such a case, find a better quality line for your modem to assure reliable data communications.

We strongly recommend that you connect the modem directly to an outside telephone line. Do not connect your modem to a private branch exchange (PBX) telephone system unless the system is guaranteed to be good enough for data transmission.

Always bear in mind that a good quality telephone line contributes significantly to reliable data transmissions.

1.6 The Power Adapter

This modem uses the 9V AC power adaptor supplied with it. Never use an out-of-specification power adaptor or it may damage your modem.

1.7 Installing the Modem

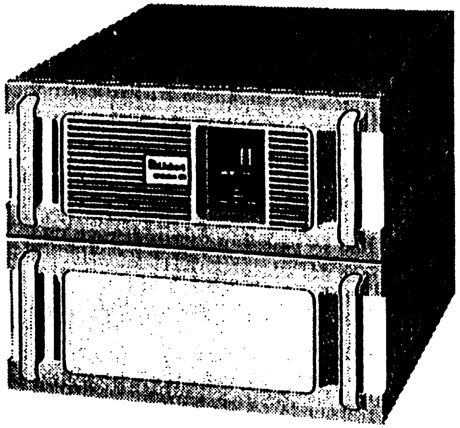
Your modem fits neatly beneath a standard telephone set. The distance between the computer and the modem is determined by the length of the RS-232C cable. However, other suitable locations for your modem are:

1) Near a reliable AC power source.
2) Close to a good quality telephone line wall outlet.
3) Where the LED indicators on the front of the modem are clearly visible.
4) Where the power switch is easily reached.
5) Where you are able to monitor the modem's carrier signal.

Follow the procedures below to connect the hardware:

UPS
Liebert
UPStation

SYSTEM DESCRIPTION



The UPStation GX is a compact on-line UPS that supplies critical equipment with computer-grade power. "On-line" means that the UPS is continuously generating and regulating its output power, regardless of whether the input a.c. supply power is present. A "standby" UPS, does not begin generating its own power until the input a.c. supply fails. Your UPStation GX is always working for you on a full-time basis.

The UPStation GX also supplies critical equipment with clean sine wave power — to simulate as much as possible the power being generated by the input a.c. supply. Sine waves are perfect for any type of equipment, whether it is computers, monitors, phone systems, laboratory instruments, or process controls.

For ease of use, the UPStation GX is provided with two LED bar displays which indicate percentage load and battery capacity. Other LED's indicate when the unit is operating on battery. The LED bar graphs may also be used to aid fault diagnosis.

The UPStation GX automatically switches to the bypass system, in the event of an internal UPS fault.

To allow communications between the UPS and the LAN server or computer system (for example, to facilitate automatic shutdown programs), the UPStation GX is equipped with an RS-232 serial communications interface port. This port provides signals which indicate the UPS status when used with *SiteNet 1* software. Also available, an SNMP option which provides communications within a network environment.

MAJOR COMPONENTS

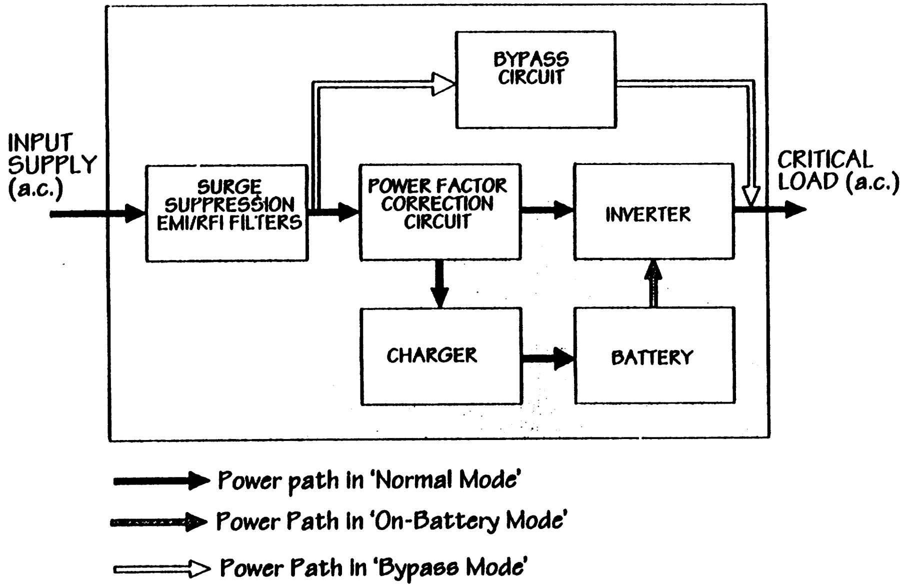


Figure 1. Block diagram of UPS

Surge Suppression and EMI/RFI Filters

The components in this section of the UPS provide surge protection and filtering of EMI/RFI (electromagnetic interference/radio frequency interference). These components will attenuate any surges or interference which may be present in the input a.c. supply line from reaching your sensitive, protected equipment.

Power Factor Correction Circuit

The power factor correction circuit ensures that the form factor of the current drawn by the UPS is sinusoidal. This achieves two objectives;
one - the power drawn from the input a.c. supply is used as efficiently as possible by the UPS, so that maximum power is generated by the UPStation GX using the minimum current;
two - the amount of distortion the UPS reflects back onto the input a.c. supply line is minimised, resulting in cleaner power being available to other users in the building.

Inverter

In normal operation, the inverter takes the d.c. output of the power factor correction circuit and converts it into regulated sine wave power. When there is a failure of input a.c. supply power, the inverter is supplied from the battery. In both modes of operation, normal and during input a.c. supply failure, the inverter is continuously generating and regulating the output power of the UPS.

Charger

The charger uses part of the output of the power factor correction circuit and regulates it to continuously charge the batteries. The charging action takes place whenever the UPS is drawing power from the input a.c. supply and the UPS power switch is on. To ensure maximum battery charge and power protection, it is recommended the UPS always be connected to the input a.c. supply line and operating continuously.

Battery

The batteries installed in the UPStation GX are of the lead acid valve regulated type. At typical room temperatures and with normal charging, the life span of the batteries is projected to be 5 years.

The batteries, which are contained within the UPS cabinet of the UPStation GX, are sufficient to maintain the UPS output at full rated power for a nominal eight minutes. If the load is reduced to 50% of full rated power, the battery time can be extended to approximately twenty five minutes.

The battery time of the system can be extended using additional battery cabinets linked to the UPS. The battery time is extended by approximately 45 minutes per additional cabinet (maximum of two additional battery cabinets allowed).

Bypass

In the event of any problem except an over-load, that would normally shut the UPS down the UPS will automatically transfer to the Bypass mode. When in the Bypass mode, the output is supplied directly from the input via the surge suppression EMI/RFI filters.

INSTALLATION INFORMATION

Note *This equipment complies with the requirements of the EMC Directive 89/336/EEC and the published technical standards. Continued compliance requires installation in accordance with these instructions and the use of manufacturer approved accessories with output cables not exceeding 10 metres in length.*

➪ Unpack the UPS carefully, noting the packing method, and retain the box and packing material. (If you must return the UPS for any reason, re-pack the item as it was originally shipped.)

Caution

These units are heavy.
Take proper precautions when lifting or moving the units.

UGX1000 RT-50	*32,0 kg.*
UGX1500 RT-50	*37,7 kg.*
UGX2100 RT-50	*44,1 kg.*

➪ Visually inspect the UPS for damage which may have occurred during shipment. If there is damage or if anything is missing, please contact the carrier and/or the distributor from whom you purchased the unit.

➪ Check on the nameplate at the back of the unit that the frequency and voltage rating are correct for your a.c. supply voltage.

➪ Your UPS should be placed in a location where air flow around the unit is not restricted. Maintain a minimum of 100 mm clearance at the front and rear of the UPS. Install the UPS in an environment which has an ambient temperature range of +10° to +35° C.

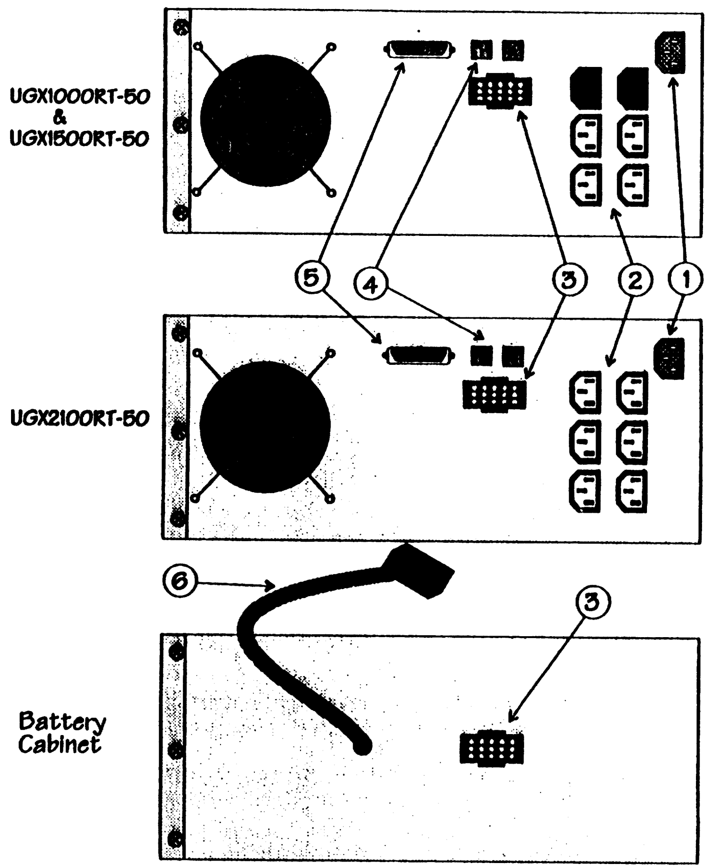
Note: *Operation of the UPS above 25° C will reduce the battery life.*

➪ Ensure that your UPS is not located where it can be accidentally turned off, or where it may come in contact with water, flammable liquids, gases, or corrosives.

The following steps are for Tower UPS installations

1. Check that the UPS power control switch on the front of the unit shown as item (1) in figure 6, is selected to the "0" OFF position.

2. Unpack the UPS output leads supplied. Check that these leads are undamaged and are correct for your requirements.



KEY TO DIAGRAM	
Item	**Description**
1	Input a.c. supply recessed plug
2	Output power sockets
3	Battery socket (for optional additional battery cabinets)
4	SNMP connectors (optional)
5	Serial communications interface
6	Battery Cabinet connection cable

Figure 2 - UPS and battery cabinet rear panel detail

3. With the equipment switched OFF, connect your load equipment into the UPS output sockets (2) shown in figure 2.
4. It is recommended that the UPStation GX is connected to a dedicated a.c. mains supply socket.
5. Connect your a.c. mains power supply into the UPS input socket (1) shown in figure 2, using the input power lead supplied separately with the UPS.

THIS MUST HAVE AN EARTH CONNECTION

You have now correctly installed your tower UPS

The following steps are for rack mount UPS installations:

1. Check that the UPS power control switch on the front of the unit, shown in figure 6, is selected down to the "0" OFF position.
2. Remove the top cover by removing the three screws on the rear of the top cover, see Figure 3 below. Push the top cover towards the back of the UPS and lift off. Remove and retain the two flange screws near the front of the UPS, these will be used to secure the flanges. Remove the top support (metal) bracket, see Figure 3 below.
3. Gently lay the unit on its right side (when viewing the unit from the front) and remove the six rubber feet, see Figure 3 below. Remove and retain the screws from the two front feet, these will be used to secure the flanges.
4. Locate the securing flanges in the top of the packing material and fasten them to the UPS using the screws retained from the previous two steps.
5. Remove the plastic template inlay from the display area to change the orientation of the display text, see Figure 4 below.

Note: *For rack mount installations, the UPS unit MUST be supported by a shelf, brackets or slide rails on each side. The securing flanges WILL NOT support the weight of the UPS.*

On installations where slides are being used, securing screws have been provided with the securing flanges located in the top of the packing material. Fasten the slides into position using these screws where required. Your UPS unit is now ready to be placed into your equipment rack.

6. It is recommended that your UPS be connected to a dedicated wall socket, properly protected by a circuit breaker or fuse.
7. Unpack the UPS output leads supplied. Check that these leads are undamaged and are correct for your requirements.

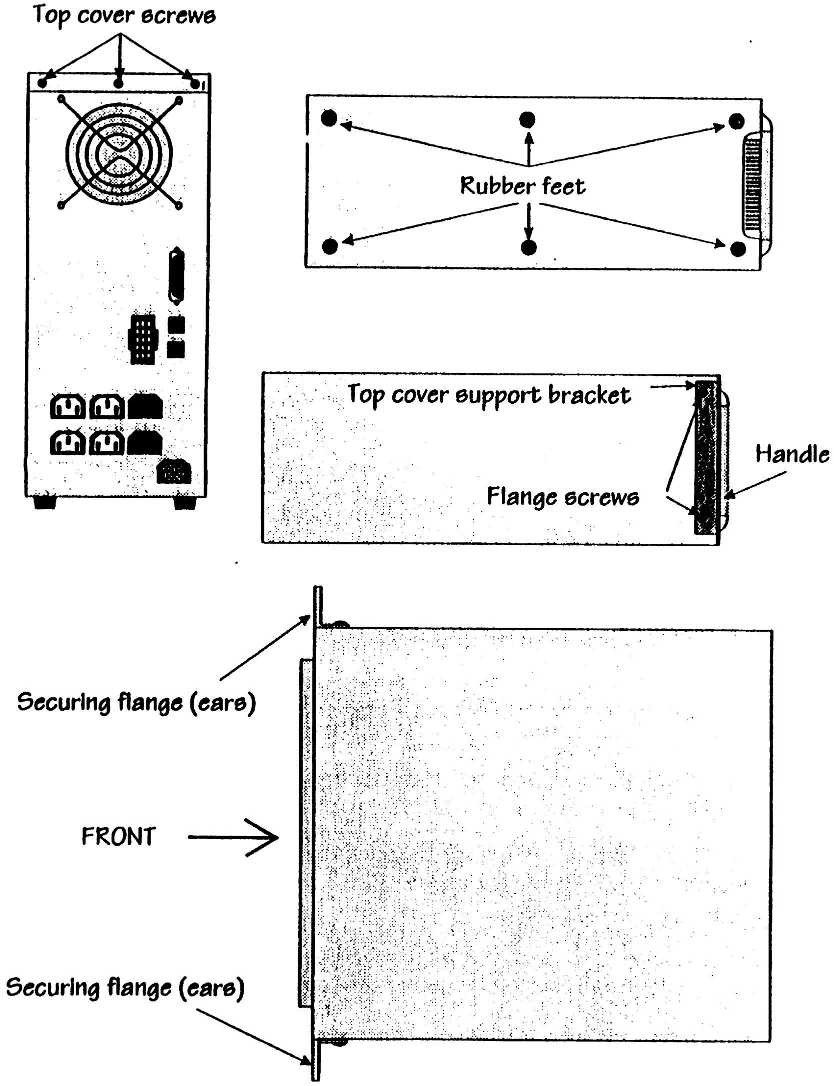


Figure 3 - Converting a Tower to a Rack mounted model

8. With the load equipment switched OFF, connect your equipment into the UPS output sockets, shown in Figure 2.

9. Connect your a.c. mains power supply into the UPS input socket (1) shown in figure 2, using the input power lead supplied separately with the UPS.

THIS SOCKET MUST HAVE A EARTH CONNECTION.

You now have correctly installed your rack mount UPS

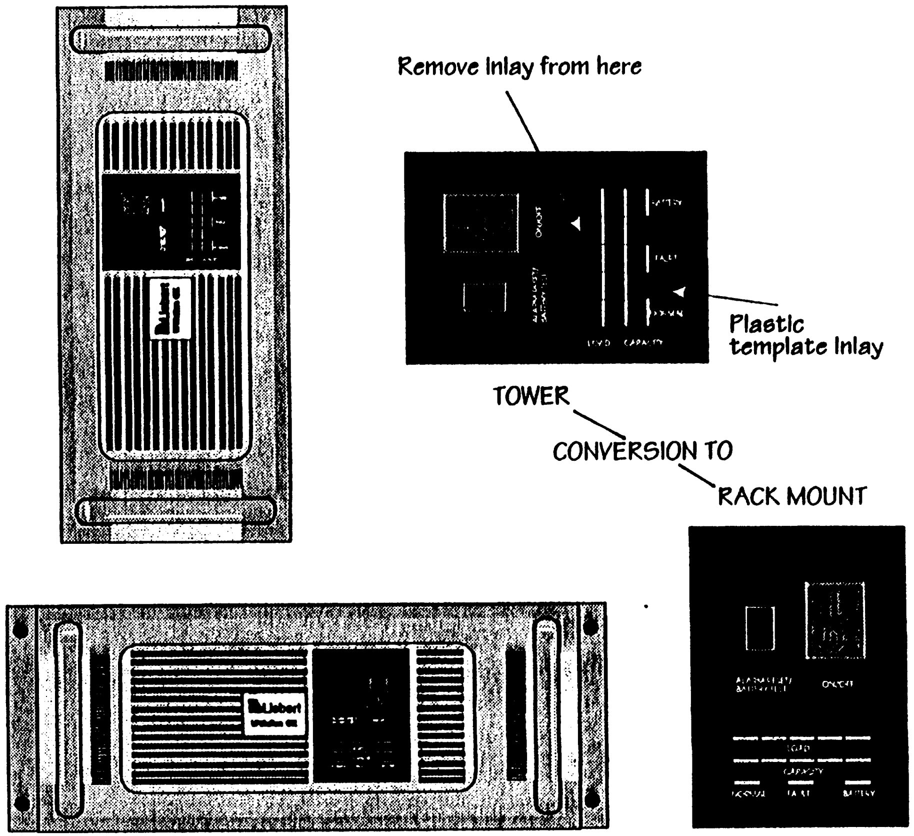


Figure 4 - Indication display conversion to Rack mount

Special installation instructions for UPS where the LOAD earth leakage is in excess of 2.75mA

To use the UPS for operating multiple loads where the cumulative earth leakage current exceeds 2.75mA, the mains input lead must be fitted with an industrial type plug and socket or be permanently connected to the mains supply. This task should be carried out by a competent electrical service engineer who is conversant with local electrical codes/regulations.

Modify the mains input lead by removing the national plug supplied. Connect the wires to a mains supply with over current protection of 16A
(13A -UK only) as follows:-

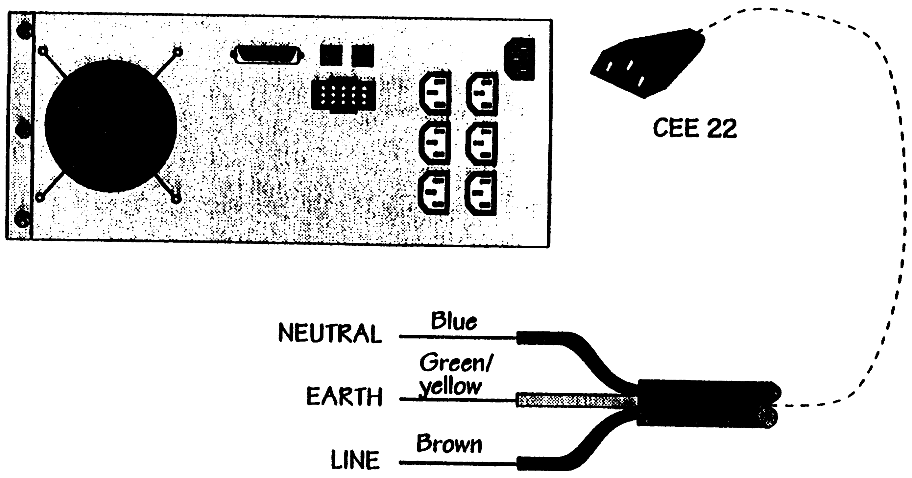


Figure 5 - A.C. Input Connector Wires - Colour Coding (European cable)

Optional battery cabinet(s)

- Up to two optional battery cabinets may be connected into the system to increase the UPS autonomy time. The battery cabinets are designed to be positioned under the UPS in a rack mount (horizontal) system or beside the UPS in a tower (vertical) configuration.
  DO NOT connect more than two (2) battery cabinets to each UPS.

RT48VBATT (UGX48VBATT) battery cabinet is to be used with RT1000-50 (UGX1000RT-50) UPS only.

RT72VBATT (UGX72VBATT) battery cabinet is to be used with RT1500-50 (UGX1500RT-50) UPS only.

RT96VBATT (UGX96VBATT) battery cabinet is to be used with RT2100-50 (UGX2100RT-50) UPS only.

- Each additional battery cabinet has an interconnecting cable for direct connection into the UPS, or the first battery cabinet on systems which include two battery cabinets.
- These battery cabinets are designed to be placed beside the UPS for tower applications, or underneath the UPS for rack mount applications.

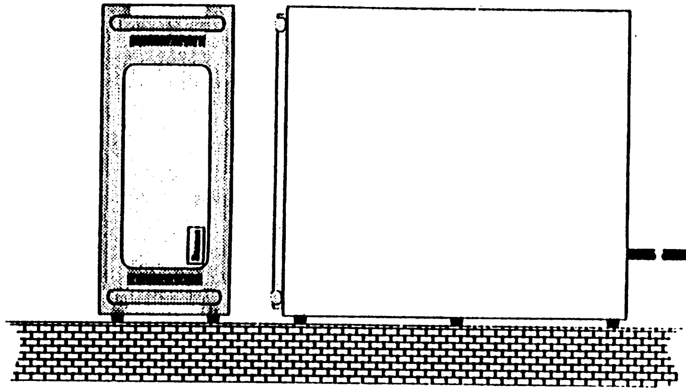
1. Unpack the UPS battery cabinet(s) carefully noting the packing method, and retain the box and packing material. (If you must return the battery cabinet(s), re-pack it as it was originally shipped.)

Caution

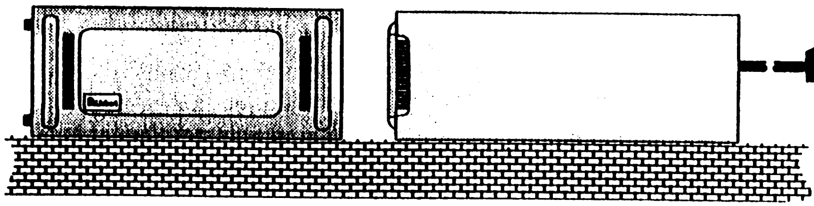
The battery cabinet(s) are heavy.
Take proper precautions when lifting or moving the units.

UGX48VBATT	*62.6 kg.*
UGX72VBATT	*50.0 kg.*
UGX96VBATT	*62.6 kg.*

For normal operation the battery cabinet must stand on a flat surface in either of the two positions shown in figure 6. Any other position which the cabinet assumes may cause instability and is likely to be hazardous if the cabinet topples because of its weight.



Vertical Position



Horizontal position

Figure 6 - Battery Cabinet safe operating positions

2. Visually inspect the battery cabinet(s) for damage which may have occurred during shipment. If there is any damage or if anything is missing, contact the carrier and/or the distributor from whom you purchased the unit.

3. Follow the same installation procedures as for the UPS, for your particular method of installation.

4. Each optional battery cabinet has a short connection cable coming out of the back panel for connecting it to the UPS (or to the nearest battery cabinet if two are used), see Figure 2. Once the cabinet(s) are in place, connect the battery cabinet connection cable to the UPS battery connector. If a second battery cabinet is used, place its battery cabinet connection cable into the battery connector on the first battery cabinet.

CONTROLS AND INDICATORS

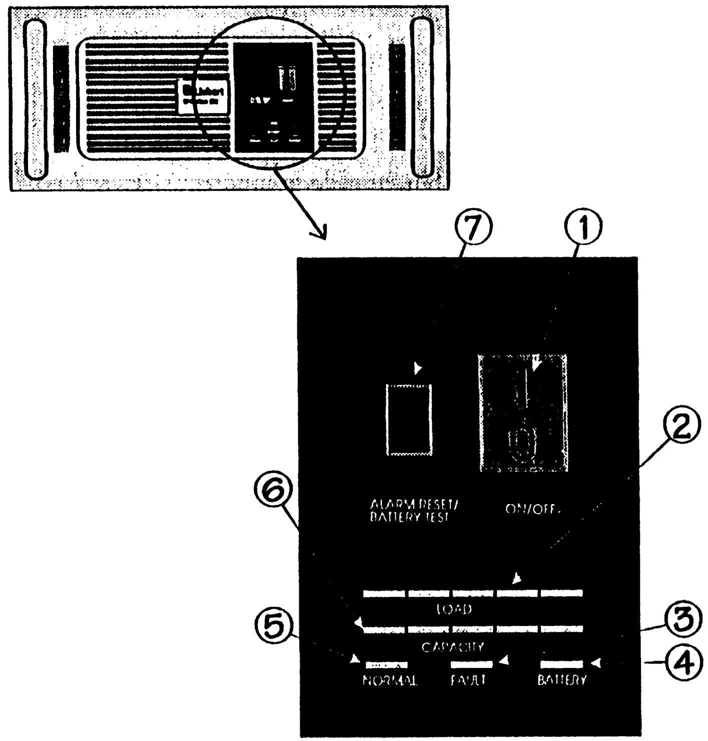


Figure 7. Front panel view

KEY TO DIAGRAM	
Item	**Description**
1	UPS power control switch
2	"LOAD" bar indicator
3	"FAULT" indicator
4	"BATTERY" indicator
5	"NORMAL" indicator
6	"CAPACITY" bar indicator
7	"BATTERY TEST/ALARM OFF" switch

(1). **UPS POWER CONTROL SWITCH**

This is the master on/off switch for the UPStation GX and controls both the input power to the UPS as well as the output power to the loads. The position labelled "I" signifies ON, and the position labelled "0" signifies OFF.

Note: *After the switch is turned OFF, the internal fan will continue to operate for approximately 5 seconds. This is normal; during this time the UPStation GX is cooling itself and dissipating its internal energy.*

(2). **"LOAD" BAR INDICATOR**

This 5-segment LED indicator shows the relative electrical load being placed on the UPS. The left most four segments are green, each segment is calibrated to light at 25% load increments until full load is reached at 100% (no LED segments will light until 20% load is reached). If the UPS is loaded beyond 100%, the red fifth segment will light.

(3). **"FAULT" INDICATOR (red)**

This indicator will be lit continuously if a UPS fault condition exists or if the unit is in the bypass mode. In an over-temperature condition, this indicator will flash and an audible alarm will sound.

(4). **"BATTERY" INDICATOR (amber)**

When lit, indicates that the UPS is in "On-Battery Mode" or that the "Battery Test" switch is depressed. An audible alarm will be activated during the time this indicator is lit.

(5). **"NORMAL" INDICATOR (green)**

When lit, denotes that input a.c. power is available and that the UPS power switch is ON. This indicator will flash if the a.c. supply voltage is high (264 volts or above).

(6). **"CAPACITY" BAR INDICATOR**

This 5-segment LED indicator shows the approximate capacity of the battery. It will light up completely when the battery is at full capacity and will extinguish segment-by-segment in 20% increments until battery capacity is exhausted. Under normal circumstances, the "CAPACITY" indicator should be fully lit.

If battery capacity is below 60% in "Normal Mode," the "CAPACITY" bar will flash its three left most LED segments regardless of the actual percentage of capacity remaining. To determine actual battery capacity, depress the "Battery Test" switch.

Typically, the "CAPACITY" indicator will flash following a power outage, when the batteries have not been fully charged. The flashing indication will therefore warn you that the full reserve battery capacity is not available. If

any applications are run under this condition the autonomy time (time on battery) will be reduced. It is therefore advisable NOT to run critical applications at this time.

If after 4 hours of recharge (or in test mode) the three left most LEDs remain blinking, replacement of the batteries may be required. Please consult your dealer.

(7). **"BATTERY TEST" AND "ALARM OFF" SWITCH**

This switch is located on the front of the UPStation GX and serves a dual purpose depending on which mode the UPS is in. In "Normal Mode" the unit will display the capacity of the battery. In the "On-Battery Mode," and "Bypass Mode" the switch acts as an "Alarm Off" switch, see Operating instructions.

OPERATING INSTRUCTIONS

- Before proceeding with the operating instructions ensure that your UPS has been installed correctly.
- Select the power control switch (1) shown in figure 7, to the ON position "I" The "normal" indicator (5) on the front of the UPS should show green and will remain green throughout normal operating conditions.
- Leave the unit switched on for at least 8 hours, to enable the battery to fully charge after storage. The unit may be used during this time, however the battery support time may be less than specified.

WARNING

IN THIS CONDITION POWER WILL ALWAYS BE PRESENT AT THE OUTPUT SOCKETS AT THE REAR OF THE UNIT.

NEVER UNPLUG THE UPS FROM THE ELECTRICAL SUPPLY WHILST IT IS IN OPERATION,
THIS WILL REMOVE THE SAFETY EARTH TO THE UPS AND ITS SUPPORTED EQUIPMENT.

- After charging, the unit is ready for use.
  Always ensure that the equipment to be connected to the UPS is switched off before attempting to plug it into the extension socket.
- Switch ON the connected equipment.

Note: *The total load connected to the output sockets, must not exceed the value stated on the UPS rating label. Your dealer will advise on the range of products that can be connected.*

- Always switch OFF the connected equipment before stopping and restarting the UPS. This will ensure that all your items of equipment will not start simultaneously when the output power is restored from the UPS, limiting artificially high power demands.

Note: *When the UPS is switched "OFF" the cooling fans continue to run for a short period at high speed.*
This is part of the normal shut down sequence.

- DO NOT switch "ON" the unit directly after switching "OFF", the UPS may not restart.
  Wait 20 seconds and then select "ON". (No damage can be caused to the UPS if an attempt to start the unit is made within the waiting period.)

- DO NOT use the power control switch on the UPS as a master switch. For complete isolation, set the power control switch to "0" (OFF) and unplug the mains lead from your electrical supply socket.

OPERATING MODES

Normal Mode

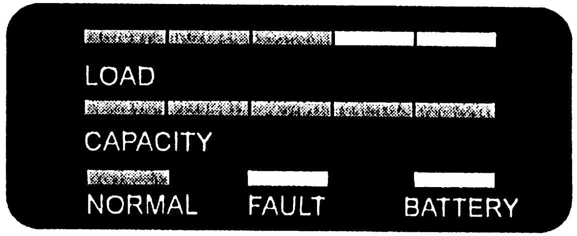


Figure 8. LED indicators during "Normal Mode"

In normal operation, input a.c. supply power is present and enters the UPS. This power is processed by the filters and by the power correction circuit. As the UPStation GX is an on-line UPS, the inverter generates and regulates output power. In normal mode, the batteries are continuously receiving energy from the charger to maintain their state of readiness. As long as the UPStation GX is in "Normal Mode", front panel indicators will appear as shown in Figure 8.

In "Normal Mode," operation of the "BATTERY TEST/ALARM OFF" switch will test the capacity of the battery. Doing this will cause the UPStation GX to go to "On-Battery Mode" (the amber "BATTERY" indicator will light and the on-battery alarm will be activated). Observe how many segments in the "CAPACITY" bar indicator are lit to determine the remaining battery capacity.

Caution

As long as the switch is depressed, the UPStation GX's batteries are being depleted, since the UPS is in "On-Battery Mode." DO NOT depress the switch for longer than necessary, especially if the UPS is supporting a heavy electrical load.

On-Battery Mode

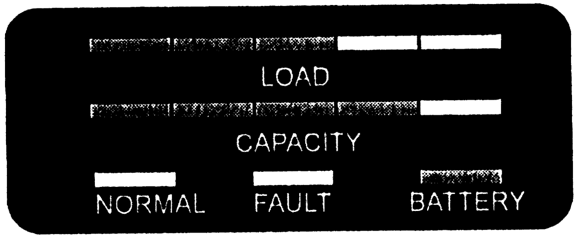


Figure 9. LED indicators during "On-Battery Mode"

If a sustained low voltage condition or complete input a.c. supply failure occurs, the power factor correction circuit can no longer supply power to the inverter. At this point, the battery supplies the inverter with power and the UPStation GX is in "On-Battery Mode". The inverter's function, continuously generating and regulating output power, is not interrupted.

In the "On-Battery Mode", the amber "BATTERY" indicator will light, warning you that an input a.c. supply failure has occurred or that input a.c. supply voltage conditions are abnormal. The "CAPACITY" LED bar indicator will show the remaining battery capacity.

At full load (i.e., at the UPStation GX's full power rating), on-battery mode can be sustained for 8 minutes (with internal batteries) before the unit automatically shuts itself off. To lengthen this time, reduce the load by turning off non-critical pieces of equipment (printers, idle computers and monitors, etc.). Do NOT turn off the UPStation GX if it is still supporting a critical load.

In "On-Battery Mode" and "Bypass Mode" the "BATTERY TEST/ALARM OFF" switch acts as an "Alarm Off" switch. Operating the switch for a *half-second* will disable the audible alarm. If the on-battery alarm has been disabled, the UPStation GX will still activate the low-battery alarm at the appropriate time. Depress the switch a second time to disable the low-battery alarm. The over-temperature warning alarm is not affected by this switch.

Bypass Mode

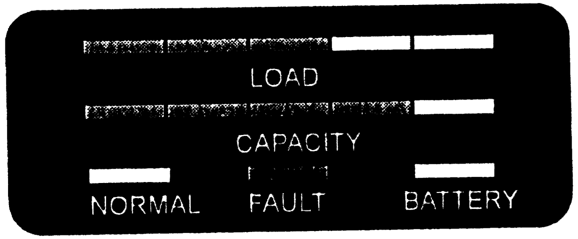


Figure 10. LED indicators during "Bypass Mode"

If the UPS transfers to the "Bypass Mode", then the UPS has either been subjected to an over-temperature or an internal over-voltage. The load is supplied from the main input power via the Surge Suppression filter circuits and is therefore not protected against power failure. The audible alarm will also sound continuously, until the "BATTERY TEST/ALARM OFF" switch (7) is pressed for half a second.

When the UPS transfers to the bypass mode the indications shown in figure 10 will be given, in addition one or more of the fault diagnostic segments of the bar indicator will illuminate.

The UPS will remain in the "Bypass Mode" until the UPS power switch (1) is reset by first selecting OFF and then ON.

Caution

Resetting the UPS power switch will cause loss of output power.
Ensure all critical loads are shut down before carrying out a reset.

ALARMS AND DIAGNOSTICS

Battery Alarms

The primary purpose of the battery alarms in the UPStation GX is to advise you that a mains failure has occurred and that the UPS can support your critical equipment for a limited period of time. The pattern of "beeps" will vary according to how much battery capacity remains:

- ❏ On-battery / Input a.c. supply failure alarm: one beep every four seconds (greater than two minutes remaining).
- ❏ Low battery alarm: four beeps per second (less than two minutes remaining).
- ❏ UPS Shutdown: a continuous tone occurs for a few seconds after the UPS switches off. Then the controls and display shut off.

High Temperature Alarm

An additional alarm is provided which indicates that the internal temperature of the UPStation GX is excessive. This alarm is two long beeps per second. The "FAULT" indicator will also flash. The UPStation GX will continue to support its critical loads, but the condition must be corrected immediately.

Caution

If the UPStation GX continues to overheat, it will eventually transfer to bypass and any loads connected to the UPS will not be protected from a mains power failure.

Bypass Alarm

The UPStation GX is a robust and durable piece of equipment, several fault conditions are critical and require the UPS to switch off and transfer the load to bypass, this prevents damage to your UPS whilst protecting the connected equipment.

If the UPStation GX shuts itself down and switches to bypass due to a fault, the condition is indicated by both the "NORMAL" and "FAULT" indicators being lit. In addition one or more of the fault alarms as indicated in the following paragraph will be lit and the audible warning gives a continuous beep.

Fault Alarms

If the UPStation GX shuts itself down due to a fault condition, the "FAULT" indicator will light. The "FAULT" indicator will also light if the UPStation GX has exhausted its battery capacity or if it receives a shutdown command via its communication interface port.

In addition to the "FAULT" light, one of several different LED segments in the "LOAD" or "CAPACITY" bar indicators will be lit *briefly*. These LED segments will indicate, as a diagnostic aid, the nature of the fault condition and the reason for the shutdown as indicated in figure 11 and the table below:-

FAULT DIAGNOSTICS DISPLAY

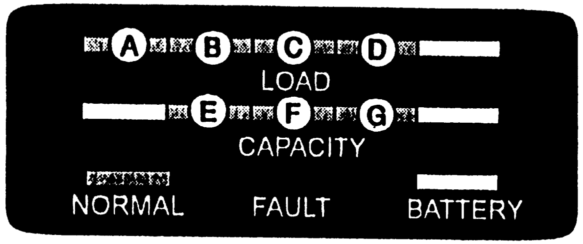


Figure 11. LED indicators during a fault condition

Indication			Fault Condition
NORMAL	FAULT	Bar Segment	
ON	ON	A	Over-temperature condition; UPS is overheated.
OFF	ON	B	Overload condition; output power rating is exceeded.
ON	ON	C	Internal d.c. bus voltage is excessive.
ON	ON	D	UPS output is short-circuited.
ON	ON	E	Internal power supply voltage is excessive.
OFF	ON	F	UPS shut down because battery time limit is reached.
OFF	ON	G	UPS shut down due to command from communication interface port.
OFF	ON	A + B	Line input voltage too low during start-up

Refer to the troubleshooting and maintenance section, to determine what you can do if your UPS shuts down, transfers to bypass or indicates one of the above shutdown codes.

UPS MONITORING AND COMMUNICATIONS

The UPStation GX is capable of communicating with a computer system, LAN server, UNIX host, terminal, modem or a network, via an EIA-standard DB-25 female connector for serial communication or the optional R45/RJ12 connectors for network communications.

This communications capability is typically used in applications which require the UPS to provide power-monitoring information to the server, host, or computer system. For instance, in the event of an a.c. supply failure, the information can be used by the operating system, or an application program, to automatically flush buffers, close files, save data, and shut down operations in an orderly fashion prior to exhausting the battery capacity of the UPS.

Serial Communications Interface

Depending on the configuration of your LAN server or UNIX host, the operating system can monitor power via the UPS, or even control the operation of the UPS itself, using a variety of adapter boards, serial ports, or other interfacing schemes. The UPStation GX's communications interface port provides the signals and control pins required by these monitoring and control applications.

By using the appropriate cable and software (sold separately as *SiteNet 1)*, the connection between the UPStation GX and your computer system can be made easily. Consult your dealer to determine the correct interface kit for your application.

Several types of signals are provided on the DB-25 (25-pin) communications interface port. These are:

PIN	FUNCTION
2	RS-232 receive data
3	RS-232 transmit data
7	RS-232 ground
9	Low battery relay contact, common
10	Low battery relay contact, normally closed
11	Low battery relay contact, normally open
12	UPS Shutdown, RS-232 level active low
16	Power failure relay contact, normally open
17	Power failure relay contact, common
18	Power failure relay contact, normally closed
19	UPS SHUTDOWN, RS-232 level active high

In addition to signals that provide power-monitoring and management information, the UPStation GX is designed to communicate intelligently with the LAN server, UNIX host, or other computer system to which it is attached. In combination with the intelligent UPS monitoring and power management software, this communications feature allows the following capabilities:

- ❐ Quantitative monitoring of mains and UPS power.
- ❐ Crisis management of your network during alarm conditions.
- ❐ Quantitative monitoring of internal UPS parameters.
- ❐ UPS ON/OFF scheduling
- ❐ Periodic tests of battery quality and replacement notification.
- ❐ Timed and delayed shutdown of the UPS.
- ❐ Logging of power disturbances and anomalies.

Consult your distributor for availability date and to order *SiteNet 2* UPS software for your system.

SNMP Option

The SNMP (Simple Network Management Protocol) option provides the UPS with the capability for intelligent communications within a network environment. This is a pre-sale factory fitted option.

Details of this system and the setting up of the option on the network is found in the SNMP (M.I.B.) Software kit. Please consult your distributor for further information.

Note: *When the SNMP option is installed the Serial data (RS-232 communications only) link is inoperative.*
The DB-25 interface may still be used with SiteNet 1 kits to provide operating system shutdown.

TROUBLESHOOTING AND MAINTENANCE

The information below summarises the symptoms you will encounter should your UPStation GX experience a problem. Use this information to determine what factors are causing the problem and what you can do to remedy it.

WARNING

DO NOT ATTEMPT TO REPAIR OR SERVICE THE UPStation GX YOURSELF. THE UPS CONTAINS POTENTIALLY LETHAL VOLTAGES, AND SHOULD NEVER BE OPENED BY ANYONE OTHER THAN TRAINED, AUTHORISED PERSONNEL.

Contact your dealer should you determine that your unit requires service beyond the suggestions in the troubleshooting chart to follow.

SYMPTOMS	POSSIBLE CAUSE(S)	SOLUTION
UPS fails to start up when UPS power switch is turned on.	UPS is not connected to the input a.c. supply.	Switch UPS off, read the installation instructions, then connect to input a.c. supply.
	Input a.c. supply voltage is below 190 volts or no input a.c. supply is available.	Call your maintenance department, qualified electrician, or electricity supply company to correct voltage, or wait until mains conditions are normal.
	UPS output is short-circuited or overloaded.	Switch UPS off. Disconnect mains a.c. input lead. Disconnect all loads and ensure nothing is lodged in output sockets. Ensure loads are not defective or shorted internally.
	Internal UPS temperature is too high.	Wait a few minutes to allow the UPS to cool down. Make sure it is well ventilated, then try again.
	Internal input fuse is blown, indicating an internal fault.	Do not attempt to service the UPS yourself. Call your dealer *.

SYMPTOMS	POSSIBLE CAUSE(S)	SOLUTION
Front panel indicators "A" and "B" are lit.	This indicates that the input a.c. supply is to low when starting the UPS.	Call your maintenance department or a qualified electrician to check the input a.c. supply voltage.
"NORMAL" indicator is flashing.	Input a.c. supply voltage is 264 volts or above.	Shut down your protected equipment, disconnect the UPS, and call your maintenance department, qualified electrician, or electricity supply company to correct voltage.
"BATTERY" LED indicator is lit and alarm beeps.	Input a.c. supply has failed or "Battery Test" switch is depressed.	You have a limited time before the UPS shuts down. Terminate critical applications and save your data. Then turn off all loads and the UPS.
UPS has reduced battery time.	Batteries are not fully charged.	Run the UPS continuously for 8 hours to recharge the batteries.
	Due to age, batteries are not able to hold a charge.	Batteries need to be replaced. Do not attempt to do this yourself. Call your dealer *.
"FAULT" indicator is flashing. Alarm beeps twice per second. Fan operates at a high speed when not on battery	The UPS is becoming overheated.	Ensure that the UPS is not overloaded, that ventilation openings are not blocked and that room temperature is normal.
UPS shuts down and transfers to bypass; "NORMAL" and "FAULT" indicators and diagnostic LED "A" are lit.	The UPS is critically overheated.	Ensure that the UPS is not overloaded, that ventilation openings are not blocked and that room temperature is normal. Wait 30 minutes to allow UPS to cool, then restart.
UPS shuts down; "FAULT" indicator and diagnostic LED "B" are lit.	The UPS is electrically overloaded.	Recalculate your loads' VA requirements. Reduce the number of loads connected to the UPS.

SYMPTOMS	POSSIBLE CAUSE(S)	SOLUTION
UPS shuts down and transfers to bypass; "NORMAL" and "FAULT" indicators and diagnostic LED "C" are lit.	Internal d.c. voltage of UPS is excessive.	This indicates an internal fault which requires service *.
UPS shuts down and transfers to bypass; "NORMAL" and "FAULT" indicators and diagnostic LED "D" are lit.	UPS output is short-circuited.	Remove source of short circuit, if obvious. Ensure that loads connected to UPS are not defective or internally shorted.
UPS shuts down and transfers to bypass; "NORMAL" and "FAULT" indicators and diagnostic LED "E" are lit.	Internal power supply voltage of UPS is excessive.	This indicates an internal fault which requires service*.
UPS shuts down; "FAULT" indicator and diagnostic LED "F" are lit.	UPS shut itself down because battery capacity is exhausted.	Turn on UPS and allow to run for at least 8 hours to charge the batteries. Running critical applications during this period is not advised.
UPS shuts down; "FAULT" indicator and diagnostic LED "G" are lit.	A shutdown signal or command was sent to the communication interface port.	If this was inadvertent, ensure that cable used is correct for your system. Call your dealer for assistance *.

* In the unlikely event your UPStation GX requires service, contact your dealer for assistance.

Maintenance

The UPStation GX normally requires very little maintenance.

The batteries are lead acid valve regulated type and only require that they are kept at full charge or near-full charge to maintain their design life. If your UPStation GX is always switched on in "Normal Mode," the batteries will be continuously charged.

If you need to store your UPS or deactivate it for any length of time, it is recommended that you charge it at least every three months. If it is necessary the cabinet can be cleaned with a damp cloth. Be certain to switch the unit off when it is not connected to the input a.c. supply. To charge the UPStation GX, connect it to the input a.c. supply and switch it on for twelve to twenty four hours.

Battery Life

The battery is designed to last for five years but this is dependent upon service conditions. Battery life is reduced by operation at high temperatures, or when left in a discharged state. Contact your dealer if you suspect that the battery needs to be changed.

Caution

Batteries must be replaced by an authorised dealer, who will dispose of the batteries according to local environmental laws.

WARRANTY

Your UPS is designed to give many years of reliable service. We recognise that you have bought the UPS to improve the reliability of your computer and we have therefore designed and manufactured the UPS to very high standards. We warrant that your UPS is free from manufacturing defects for a period of 2 years from purchase.

The warranty does not apply to products which have been abused; mishandled; modified; damaged by act of God or source external to the product; repaired by others; or which have their serial numbers removed or altered.

Important safety instructions for qualified personnel

IMPORTANT SAFETY INSTRUCTIONS FOR
RT48VBATT, RT72VBATT AND RT96VBATT

1. SAVE THESE INSTRUCTIONS -This manual contains important instructions that should be followed during installation and maintenance of the UPS and batteries.
2. Servicing of batteries should be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorised personnel away from batteries.
3. When replacing batteries, use the same number and type of sealed lead-acid batteries.
4. CAUTION - Do not dispose of the battery or batteries in a fire. The battery may explode.
5. CAUTION - Do not open or mutilate the battery or batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.
6. CAUTION - A battery can present a risk of electric shock and high short circuit current. The following precautions should be observed when working on batteries.

   "ELECTRICAL SHOCK"

   i. Remove rings, watches, or other metal objects.
   ii. Only use tools with industrial insulated handles.
   iii. Wear rubber gloves and boots.
   iv. Do not smoke near the battery.
   v. Do not lay tools or metal parts on top of batteries.
   vi. Disconnect charging source prior to connecting or disconnecting battery terminals
   vii. In the event of a battery breakage occurring, dispose of the battery in a container resistant to sulphuric acid.
   viii. Should electrolyte contact the skin , wash the affected area immediately.
7. Maximum ambient temperature around the power supply must not exceed 35°C.
8. The fuse should only be replaced by type 314, 25A, 125V, MANUFACTURER LITTELFUSE.
9. RT48VBATT battery cabinet is to be used with RT1000-50 UPS only.
10. RT72VBATT battery cabinet is to be used with RT1500-50 UPS only.
11. RT96VBATT battery cabinet is to be used with RT2100-50 UPS only.

Specifications

UPStation GX			
Model	**RT1000-50**	**RT1500-50**	**RT2100-50**
Part Number	UGX1000RT-50	UGX1500RT-50	UGX2100RT-50
INPUT			
Voltage Range	180 - 264 V a.c. On start-up input voltage must be above 190V a.c.		
Frequency	50Hz ± 5%		
Current (nominal)	4,5A	6,0A	10A
OUTPUT			
Rating	1000VA/ 700W	1500VA/ 1050W	2100VA/ 1500W
Voltage (nominal	230V a.c.		
Voltage Regulation	± 3%		
Frequency Locked to Utility Free Running	50Hz ± 1 Hz 50Hz ± 0.5 Hz		
Output Distortion	Max. 5% THD		
Waveform	Sine wave		
Overload	300% sub-cycle; 200% full load amps for 10 cycles max.; 120% full load amps for 1 second		
Current (nominal)	4,4A	6,5A	9,0A
Load Power Factor Range	0,6 to unity		
BACKUP OPERATION			
Battery Reserve	full load - nominal 8 minutes @ 25°C		
Nominal Voltage	48V d.c.	72V d.c.	96V d.c.
Transfer Time	Uninterrupted		
Battery Recharge Time	8 hours (from full discharge)		
Battery Type	Low Maintenance Valve Regulated Lead Acid		

UPStation GX			
Model	RT1000-50	RT1500-50	RT2100-50
Part Number	UGX1000RT-50	UGX1500RT-50	UGX2100RT-50
External Batt. Cabinet Model Number Part Number	RT48VBATT UGX48VBATT	RT72VBATT UGX72VBATT	RT96VBATT UGX96VBATT
Battery Quantity and Rating UPS External Cabinet	4 x 12V/7,0 AH 8 x 12V/17,0 AH	6 x 12V/7,0 AH 6 x 12V/17,0 AH	8 x 12V/7,0 AH 8 x 12V/17,0 AH
Battery reserve with: One additional battery cabinet	>90 minutes	>40 minutes	>40 minutes
Battery reserve with: Two additional battery packs	>170 minutes	>80 minutes	>80 minutes
ENVIRONMENTAL			
Operating Ambient Temperature	+10°C to +35°C		
Non-operating (storage) Temperature	-35° to +50° C (without battery), -20° to +40° C (with battery)		
Relative Humidity	0 to 95% non-condensing		
Operating Altitude	Full rating, up to 3000 metres		
PHYSICAL			
Dimensions (mm) Overall Width x Height x Depth	19" x 7" x 21" 483mm x 178mm x 534mm		
Weight (kg) UPS Optional Battery	32,0 62,6	37,7 50,0	44,1 62,6
Receptacles Input Output	1 CEE22 connector 4 CEE22 connectors	1 CEE22 connector 4 CEE22 connectors	1 CEE22 connector 6 CEE22 connectors

Warranty Card

Thank you for purchasing an Emerson UPS. This UPS is warranted free from Manufacturing defects for a period of 24 months from the date of purchase. Please complete the form below and return to us for warranty registration.

In the event of any fault or difficulty, please contact the dealer from whom you purchased the UPS.

Model No [ ] Serial No [ ] Date Purchased [ ]

Dealers Name and Address ....

....

.... Post Code ....

Your Name ....

Company ....

Address ....

.... Post Code ....

Emerson Electric UK Ltd, Elgin Drive, Swindon, SN2 6DX England.
Tel: +44 (0)1793 553355, Tlx449101 EMELEC G. Fax +44 (0)1793 553401

TECHNICAL BULLETIN

Number: 97-009 Date: August 29, 1997

TROUBLESHOOTING FAIRCHILD SM2900 MODEM PROBLEMS

Purpose: To describe causes for erratic or intermittent circuit performance on Fairchild SM2900 Modems with the Reed-Solomon option enabled and/or a Viterbi decoder installed, and to recommend possible solutions

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PROBLEM DESCRIPTION

Orion has experienced a variety of performance problems with Fairchild SM2900 Modems using the Reed-Solomon and/or Viterbi decoder option(s). Problems Orion has seen includes erratic or intermittent circuit performance, unexplained fault alarms, or incorrect status readings.

Four problematic scenarios have been identified.

1. Clock oscillator(s) come loose or fall off the Reed-Solomon circuit board during shipping.
2. Terminals in the female connector, J9 on the M&C board,are bent or pushed down so that a poor connection is made when the Reed-Solomon board is installed.
3. TX FIFO errors occur when operating at high data rates with the Reed-Solomon option enabled.
4. When operating demodulator at low data rates with Reed-Solomon compatible Viterbi decoder board, the BER reading is incorrect or low.

SM2900 CIRCUIT BOARD LOCATION

The Fairchild SM2900 has three main circuit boards: the M&C board, the demodulator board, and the modulator board. The M&C circuit board, which is the top board in the SM2900 unit, sometimes has an optional Reed-Solomon board attached. Figure 1 shows how the Reed-Solomon board attaches to the M&C board and where TX FIFO hardware upgrade is located.

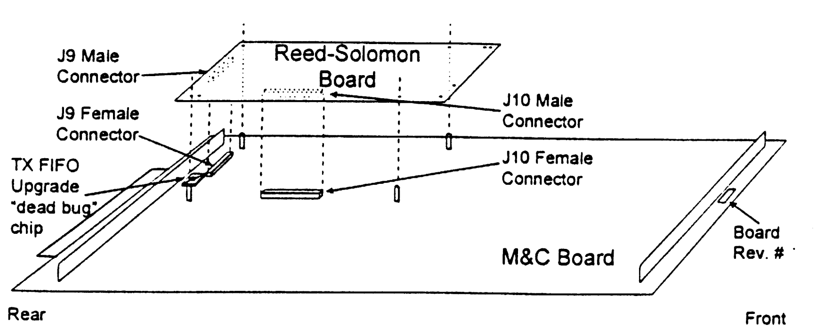
The demodulator board, which is the middle board in the chassis, requires a decoder board. The SM2900 Modem has either a Sequential or Viterbi decoder board installed on the demodulator board. The Viterbi board part number is either 005719-008 for systems without the Reed-Solomon option, or 005719-031 for systems with the Reed-Solomon option. Figure 4 shows how the decoder board attaches to the demodulator board and where the revision number is located.

Generally the boards are installed in the SM2900 unit before shipment; however, a Reed-Solomon board or Viterbi decoder board may be exchanged or installed in the field during an circuit upgrade.

Troubleshooting Reed-Solomon Problems on M&C Board

If the erratic performance disappears when the Reed-Solomon option is disabled, the chances are good that the problem is with either the mating connectors or the clock oscillators on the Reed-Solomon board.

Figure 1. *SM2900 M&C Board with Reed-Solomon Option*

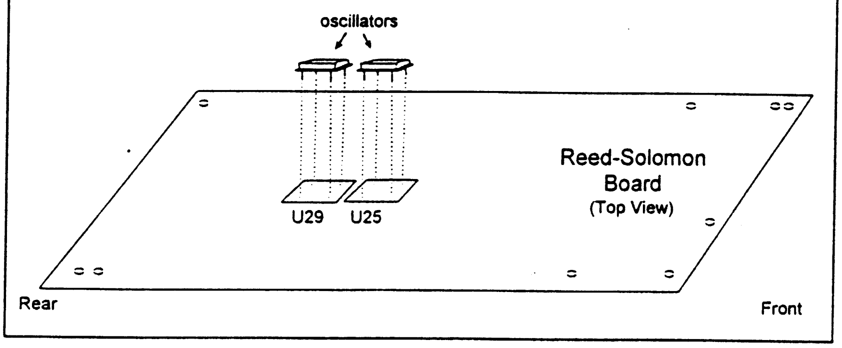


To inspect the mating connectors and the clock oscillators:

1. Turn off the power to the SM2900 Modem.
2. Remove the M&C board (top circuit board) from the chassis.
3. Inspect the Reed-Solomon board for loose or missing clock oscillators. If one or both of the oscillators is loose or missing, follow the procedures in "Loose Clock Oscillator Correction" on this page.
4. Remove the Reed-Solomon board from the M&C board, and inspect the terminals in the mating connectors. See "Problems with the Reed-Solomon Board Mating Connectors" on page 3.
5. Verify the revision number of the M&C board, and look to see if the TX FIFO upgrade chip is in place. See "TX FIFO Error With Reed-Solomon

To reinstall the board, follow the guidelines for installing the Reed-Solomon board found in "Installing Reed-Solomon Circuit Board onto SM2900 M&C Circuit Board" on page 3.

Figure 2. *Oscillators on a Reed-Solomon Board*



Loose Clock Oscillators on Reed-Solomon Board

The oscillators on the Reed-Solomon circuit board are not soldered to the board. Instead, they are fitted into tiny pin sockets in the board. During shipment oscillators may come loose or fall off the circuit board. If the oscillators become loose or fall off the circuit board, the Reed-Solomon option may not work when the option is enabled. (See Figure 2.)

Oscillators can be identified by the printing on their tops. The first two rows of printing reads, "VF940-100, 28.633144MHZ." The third row is a 4 digit date code.

The pin sockets are inside squares labeled, "U29" and "U25."

Loose Clock Oscillator Correction

To correct a problem with loose or missing clock oscillators,

1. Turn off the power to the SM2900 Modem.
2. Remove the M&C board (top circuit board) from the chassis.
3. Inspect the Reed-Solomon board for loose or missing clock oscillators. If one or both of the oscillators is missing, look in the Modem chassis to find it.

4. Inspect the oscillator to determine whether the pins have been damaged.
5. If the pins are solidly attached, and can be slipped back into the pin sockets, put a small amount of silicon sealer on the circuit board, under the oscillator mounting position, and carefully put the oscillator back into place. The silicon sealer bonds the oscillator to the circuit board to keep it from becoming loose.
6. If the oscillator sustained damage so that it cannot be reinserted, or if the oscillator cannot be found, contact Logistics to arrange repair.

Problems With the Reed-Solomon Board Mating Connectors

The most frequently identified problem Orion has found with the Reed-Solomon mating connectors is that the 25B terminal on the J9 connector is pushed down too far causing a bad connection between the Reed-Solomon board and the M&C board. An erratic signal exhibiting high bit error rate is likely to occur. Sometimes faults show for both the demodulator and the modulator. The Modem does not respond to attempts to clear the faults. The faults persist and cannot be cleared. Although particular attention should be paid to the 25B position in the J9 connector, four terminals should be checked.

1. Turn off the power to the SM2900 Modem.
2. Remove the M&C board (top circuit board) from the chassis.
3. Inspect the terminals in the J9 and J10 on the bottom of the Reed-Solomon circuit board.
4. Inspect the terminals in the J9 and J10 on the top of the M&C board.
5. If any of the terminals appear to be bent or damaged, contact Logistics to arrange repair. Do not attempt to repair the terminals yourself.

Installing Reed-Solomon Circuit Board onto SM2900 M&C Circuit Board

Fairchild recommends the following procedure for installing the Reed-Solomon board onto the SM2900 M&C board.

1. Inspect mating connectors on back side of Reed-Solomon board for damage (bent terminals).
2. Inspect J9 and J10 on the M&C board for damaged terminals.
3. If no visual damage is observed on the mating connectors, position the Reed-Solomon board, on the M&C board, so that the four mounting holes align with the four support posts on the rear of the M&C board. If installing the Reed-Solomon board for the first time, remove the Phillips head screws from the four mounting posts in the rear right quadrant of the M&C board.
4. Press the Reed-Solomon board into place beginning with the rear of the board so that the two male connectors on the back of the board are fitted into the two female connectors on the M&C board.

   Important! The J9 connector must be fitted first.
5. Fasten the Reed-Solomon board into place with the four Philips head screws.

TX FIFO Error With Reed-Solomon

Revision D02 or higher of the Fairchild SM2900 M&C boards have a hardware modification to resolve TX FIFO errors when operating at high data rates. The TX FIFO error is attributed to a clocking limitation. The actual modification is an addition of a 14 pin DIP IC chip mounted upside down on the M&C circuit board in a "dead bug" style. This IC chip is located adjacent to connector J9. (See Figure 1)

If the TX FIFO error occurs, possibly combined with sync loses and rolling DPU errors, the M&C board may need to be upgraded.

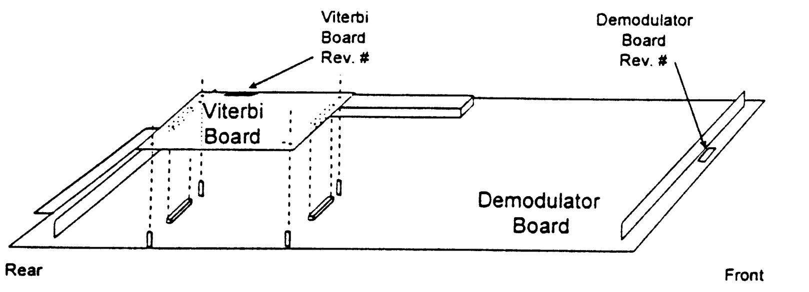
1. Turn off the power to the SM2900 Modem.
2. Pull the M&C board (top circuit board) from the chassis far enough to read the revision number.
3. Look for the revision code label located on the front edge of the M&C board. The revision code appears as either "RD02" or "REV-D02."
4. If the board is not Rev. D02 or higher, contact Logistics to arrange for an upgrade.

To check the revision number for the Viterbi Board:

1. Turn off the power to the SM2900 Modem.
2. Remove the demodulator board (middle circuit board) from the chassis.
3. Look for the revision code label located on the interior side edge of the Virterbi board. The revision code appears as either "RE01" or "REV-E01."
4. If the board is not Rev. E01 or newer, contact Logistics to arrange for an upgrade.

Troubleshooting Problems With the Viterbi Decoder Board

Figure 3. *SM2900 Demodulator Board with Viterbi Option*



In the Fairchild SM2900 Modem with Viterbi option, the Viterbi circuit board is mounted on the demodulator circuit board. (See Figure 3.)

When using the SM2900 Modem with the Reed-Solomon option and a Reed-Solomon Compatible Viterbi decoder board, Orion has experienced problems obtaining a Modem status reading.

Low BER Reading with Viterbi Decoder

If an unusually low BER rate is displayed, when checking the SM2900 Modem status, chances are that the Viterbi decoder is faulty. Revision number E01 or higher for the Viterbi decoder, part number 005719-031 has a firmware correction to resolve the low BER status reading.

What To Do With Defective Boards?

With the exception of replacing a loose clock oscillator on the Reed-Solomon board, do not attempt to correct the problems in the field. If a defective board is identified, contact the Logistics department to arrange for repair or replacement.

ORION ATLANTIC

TECHNICAL BULLETIN 004

18 March 1996

Required Tools, Materials and Test Equipment for VSAT Installations

The following is a list of tools, materials and test equipment required to perform installation and repair of Orion VSAT systems along with typical prices and sources in the US.

Please review the lists and make sure that you have all these devices available. If you have a problem obtaining any of the items, please advise Orion's Implementation Manager immediately, and we will help you find sources for these items.

Mechanical Tools Required to build 2.4 meter 1244 Prodelin

- 1 ratchet, 3/8" or 1/2" drive
- 1 socket, 1/2" or 13mm Deep Well
- 1 socket, 3/4" or 19mm Deep Well
- 1 socket, 1-1/8" or 29mm Deep Well
- 1 wrench, combination 5/16" or 8mm
- 1 wrench, combination 1/2" or 13mm
- 1 wrench, combination 3/4" or 19mm
- 1 wrench, combination 15/16" or 24mm
- 1 wrench, combination 1-1/8" or 29mm
- 1 wrench, combination 1-1/2" or 38mm
- 1 screwdriver, Standard Blade
- 1 screwdriver, Cross blade
- 1 10" adjustable Crescent wrench
- 1 Allen wrench, 5/32"
- 1 3" or 76mm wrench (Socket, Crescent or pipe wrench) for 2" to 4.5 " bolt

Estimated total cost for these tools $200.00

Mechanical Alignment Tools

The following tools from the company listed below are suggested for the initial alignment to the satellite:

Source: McMASTER-CARR Supply Company
P.O.Box 440
New Brunswick, NJ 08903-0440
(908)329-3200 Fax (908)329-3772

1 Compass, P/N 19935A65	$60.00
1 Inclinometer 0.2% accuracy P/N 21365A776 w/10"base	$117.00

Crimp Tools

Gilbert Crimp Tools (depending on cables used
-- typical price for complete set) $200.00
Orion can arrange a source for you to buy them.

Required Basic Tool Kit

Source: Techni-Tool
5 Apollo Road
P.O. Box 368
Plymouth Meeting, PA 19462-0368
(610)941-2400 Fax (610)828-5623

Tool kit 8801-10-2, or equivalent tools **$510.00**

- Batteries 2D
- Pliers, Ignition, Midget slip Joint, 5" OAL
- Blade, slotted 5/16" screwdriver
- Pliers, Locking Long Nose, Long Chain Nose
- Burnisher, Contact Heavy Duty
- Pliers, Short Chain Nose Probe, #1 Pointed
- Caliper, Pocket, SS 4" capacity
- Probe, #17 Angled, #23 Curved, #6, Curved
- Case, TEC-TUFF
- Puller, Fuse Midget Non-Slip for 1/4"- 1/2"
- Dip Clip, 16 Pin, STD.
- Punch, Center, 3/32"
- Extension, 4"
- Punch, Pin, 1/8", Drive pin 1/16" .040 120 & 80 grit
- File Set, Field service 12 pcs., Swiss pattern
- Screwstarter, 6 1/2" OAL 3/16" Blade, Quickwedge
- Screwstarter, Phillips 5 3/4" OAL, w/ Pocket Clip
- Solder Removal Tool
- File, Fine, Plastone
- Speedy Bend, 1, for 1/4" 1/2" Watt Diodes
- Flashlight, Penlight 2 cell
- Spring Hook Set, 8 PCS. SS
- Heat Sink, for dual inline packages
- Test Lead, Kit 50-in-1 w/Vinyl Case
- Heat Sink, Medium
- Tweezers, Delrin, Glass Filled, Flat Round Points
- Hex Key, Set, Metric short arm
- Vise, Mini Vacu
- Inserter/Extractor, 4-48 pin

- Wrench Set, Ignition, 7/32" thru 7/16", w/Pouch
- Key Cap Remover, for 3/4"

More tools listed in catalog that are included in this box:

- Lead Cleaner
- Pin Vise, .032-.063" 2.75"OAL

Other required tools for tool box

Source: Specialized Products Co.
3131 Premier Drive
Irving, TX 75063
(800)866-5353 Fax (800)234-8286

• BLX Bondhex Ballpoint L-Wrenches Sets, Inch size	
• Metric size No. 204SC054 (9pc) 1.5-10mm	$15.35
• Telemaster Economy Telecom Crimp tool No. 702ST301 (RJ45/RJ11)	$49.95
• Blue Box II 100 Breakout Box & Cable Tester No. 474TE100 Model 100	$230.00
• 620X450 RJ-45 test adapter	$16.50
• 350X055 Dracon Punch down Tool	$58.25
• 350X221 Kron Punch bit	$42.50
• 350X100 110 Punch Bit	$21.00
• 060X870 Cable Cutter	$19.00
• 060X052 Diagonal Cutter	$14.50
• 367X701 Tone/Probe Kit	$92.00
• 350X090 Dracon Modular Adapter	$12.25
• 087X400 Utility Knife	$5.00
• 087X420 Replacement Blades	$2.00
• 175X998 Screwdriver set	$28.90
• 376X050 Coax Adapter Kit	$150.00
• 690X800 Telco Line tester	$6.00
• 045X187 Fluke 87 Multmeter VOM	$335.00

Test Equipment — *TYPICAL*

• TTC 6000 Firebird with TTC 42522 Interface V.35/X.21/Rs	449 data Interf
• HP 8591 Spectrum Analyzer, 50 MHz to 14.5 GHZ, KHZ RBW, -95 dBM sensitive or better, ± 250 Mz frequency accuracy.	$10,000.00
• Fixed Attenuator Set, 75 ohm and 50 ohm 2 each 1, 2, 3, 5, 10, 15, 20	$140.00
• Test Cables - 1 set #1 thru 20 or what ever the latest version of	cables is availabl
• V.35 Breakout box	$600.00

Extra Materials

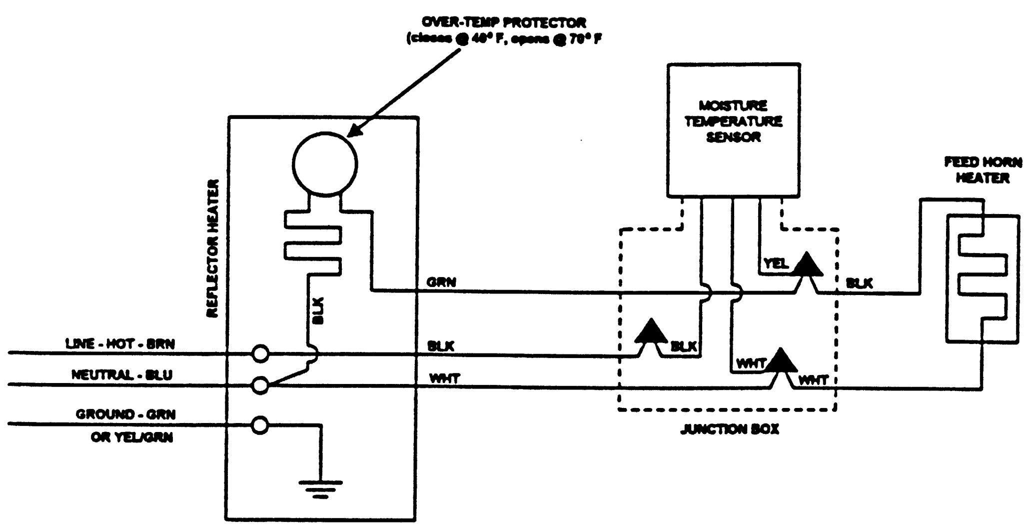
• Connectors both Male and Female are needed F type to BNC,		BN
• Genders Benders for dB 9, 15, 25 and 37 pin	$100.00	
• Materials to fabricate cables, Pins for V.35 dB 25 plus hoods		and

ORION ATLANTIC

TECHNICAL BULLETIN 003

Effective 28 February 1996

Prodelin 1.8 Meter and 2.4 Meter ETSI Compliant Antenna De-ice System



WIRING DIAGRAM FOR PRODELIN 230V ANTI-ICING
1.8 M & 2.4 M ETSI COMPLIANT ANTENNA

NOTE: the 230V moisture/temperature sensor does not have any LED's on the bottom of the case as shown in the instructions.

The Quad # 2 reflector heater assembly includes an over-temperature protector installed as part of the heater element circuit as shown in the diagram above. The protector opens at an outside temperature of 70^0 F and closes at 40^0 F. Please be aware that the operation of the protector can cause inaccurate results of de-ice system testing, as noted below.

1. With the de-ice turned on, the feedhorn heater may be producing heat when no heat is evident on the reflector panel. This can be caused by the protector being open due to the outside temperature.

TECHNICAL BULLETIN 003

Effective 28 February 1996

2. An extremely high resistance measurement of the heater element can be caused by the protector being open due to the outside temperature.

Since there is no bypass installed for the over-temperature protector, consistent de-ice system testing can only be accomplished at temperatures below 40^0 F.