Meridian 1

Spares planning

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Revision history

April 2000

Standard 14.00. This is a global document and is up-issued for X11 Release 25.0x. Document changes include removal of: redundant content; references to equipment types except Options 11C, 51C, 61C, and 81C; and references to previous software releases.

June 1999

Standard, release 13.00. This document is reissued to include he NT5D03 Call Processor Card and minor edits. Changes to technical content are noted by revision bars in the margins.

October 1997

Standard, release 12.00. Changes are noted by revision bars in the margins.

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Standard, release 11.00. Changes to technical content are noted by revision bars in the margins.

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Standard, release 10.00. This document is reissued to include the Fiber Remote Multi-IPE units. Changes to technical content are noted by revision bars in the margins.

December 1995

Standard, release 9.00. This document is reissued to include the NT9D19 Call Processor Card and minor edits. Changes to technical content are noted by revision bars in the margins.

July 1995

Standard, release 8.00. This document is reissued to include international information to create a global NTP and Meridian 1 option 81C. Changes to technical content are noted by revision bars in the margins.

December 1994

Standard, release 7.0. This document is reissued to include Small Systems Multi Disk Unit (SMDU), option 51C, and failure rate information updates. Changes to technical content are noted by revision bars in the margins.

April 1994

Standard, release 6.0. This document is reissued to include information on Meridian 1 system option 61C. New information and changes to technical content are noted by revision bars in the margins.

April 1993

Standard, release 5.0.

December 1992

Standard, release 4.0. This document is reissued to include information on system option 81 and equipment required for compatibility with X11 release 18. New information and changes to technical content are noted by revision bars in the margins.

December 1991

Standard, release 3.0. This document is reissued to include technical content updates. Due to the extent of changes revision bars are omitted.

December 1990

Standard, release 2.0. Reissued to include MTBF information for station equipment.

January 1990

Standard, release 1.0.

Contents

About this document

This document is a global document. Contact your system supplier or your Nortel Networks representative to verify that the hardware and software described is supported in your area.

This document provides the information needed to calculate and plan for spare (replaceable) equipment. This guide also provides hardware failure rates.

References

See the Meridian 1Planning and Engineering Guide for:

- *System Overview* (553-3001-100)

- *Installation Planning* (553-3001-120)

- *System Engineering* (553-3001-151)

- *Power Engineering* (553-3001-152)

- *Equipment Identification* (553-3001-154)

See the X11 software guide for an overview of software architecture, procedures for software installation and management, and a detailed description of all X11 features and services. This information is contained in two documents:

- *X11 System Management* (553-3001-300)

- *X11 Features and Services* (553-3001-306)

See the *X11 Administration* (553-3001-311) for a description of all administration and maintenance programs, and see *X11 System Messages Guide* (553-3001-411) for information about system messages.

Spares planning

Content list

The following are the topics in this section:

Definitions and assumptions

Failure rate—Failure rate equals the estimated number of failures for that item during one million (10^6) hours of operation. The only exception is to measurements for cabling or other items with low failure rates. Rates are also measured in Failures in Time (FIT) measurements. One FIT equals one billion (10^9) hours of operation.

Sparing interval—The sparing interval is the period of time that stocks of replaceable items should last without being replenished. This period is assumed to be one year following the installation of the system.

Stock confidence level—The stock confidence level is the allowed probability of not being out of stock when the sparing interval of one year is greater than 99.9 percent.

Card ambient temperature—The card ambient temperature is the average temperature of the air immediately surrounding the circuit card (usually higher than the ambient room temperature). Card failure rates in this document are based on a card ambient temperature of 40 degrees C (104 degrees F).

Turnaround time for repair—Equipment may be serviced at a repair house or at a centralized depot that serves subdepots. The turnaround time for the return-to-stock of a failed item is about ten working days (240 hours) from a repair house. The turnaround time for the return-to-stock of a failed item is about two working days from a centralized depot.

Actual turnaround periods vary in the field. As the number of systems served increases, the percentage of replaceable items required in stock is reduced.

Population range—Population range is the quantity of each type of system in the area served by the depot.

Spare stock size—The quantity of spares for a given stock item depends on the sparing interval, stock confidence level, failure rate, turnaround time for repair, and population range.

Calculating spares requirements

Use the following procedure to calculate the number of spares required to stock a depot for a one-year sparing interval:

1   Determine the number (N) of in-service specified circuit cards serviced by the depot.

2   Look up the card failure rate (F) for the specified circuit card in "Failure rates" on page 19.

Card failure rates are expressed in terms of the number of failures per million hours (10^6).

3   Determine turnaround time (T) in hours.

For repair house service, turnaround time is typically ten working days (240 hours). For centralized depot service, turnaround time is typically two working days (48 hours).

4   Calculate the NFT value by multiplying N x F x T.

5   Look up the number of spares required in "NFT values" on page 13.

Example: A centralized depot services 10,000 NT8D02 Digital Line Cards. The failure rate given for this card is 1.8 failures per 1 million hours. With a turnaround time of 48 hours:

$$\text{NFT} = 10,000 \times \frac{1.8}{1,000,000} \times 48 = 0.864$$

The number of spares required for an NFT value of 0.864 = 6.

NFT values

Table 1 translates NFT values to the number of spares required in stock. The following abbreviations are used:

N—Number in use

F—Failure rate

T—Turnaround time (in hours)

Table 1
Number of spares required (Part 1 of 6)

NFT values		Number of spares	NFT values		Number of spares
From	To		From	To	
0	0.001	1	5.16	5.76	15
0.001	0.0452	2	5.76	6.37	16
0.0452	0.189	3	6.37	6.99	17
0.189	0.425	4	6.99	7.62	18
0.425	0.734	5	7.62	8.26	19
0.734	1.09	6	8.26	8.91	20
1.09	1.5	7	8.91	9.57	21
1.5	1.95	8	9.57	10.2	22
1.95	2.43	9	10.2	10.9	23
2.43	2.94	10	10.9	11.5	24
2.94	3.46	11	11.5	12.2	25
3.46	4.01	12	12.2	12.9	26
4.01	4.58	13	12.9	13.6	27
4.58	5.16	14	13.6	14.3	28

Table 1
Number of spares required (Part 2 of 6)

NFT values		Number of spares	NFT values		Number of spares
From	To		From	To	
14.3	15	29	34.7	35.5	56
15	15.8	30	35.5	36.3	57
15.8	16.5	31	36.3	37.1	58
16.5	17.2	32	37.1	37.9	59
17.2	17.9	33	37.9	38.7	60
17.9	18.7	34	38.7	39.5	61
18.7	19.4	35	39.5	40.3	62
19.4	20.1	36	40.3	41.1	63
20.1	20.9	37	41.1	41.9	64
20.9	21.6	38	41.9	42.7	65
21.6	22.4	39	42.7	43.5	66
22.4	23.1	40	43.5	44.3	67
23.1	23.9	41	44.3	45.2	68
23.9	24.6	42	45.2	46	69
24.6	25.4	43	46	46.8	70
25.4	26.2	44	46.8	47.6	71
26.2	26.9	45	47.6	48.4	72
26.9	27.7	46	48.4	49.2	73
27.7	28.5	47	49.2	50	74
28.5	29.2	48	50	50.9	75
29.2	30	49	50.9	51.7	76
30	30.8	50	51.7	52.5	77
30.8	31.6	51	52.5	53.3	78
31.6	32.4	52	53.3	54.2	79
32.4	33.2	53	54.2	55	80
33.2	33.9	54	55	55.8	81
33.9	34.7	55	55.8	56.6	82

Table 1
Number of spares required (Part 3 of 6)

NFT values		Number of spares	NFT values		Number of spares
From	To		From	To	
56.6	57.5	83	79.3	80.2	110
57.5	58.3	84	80.2	81	111
58.3	59.1	85	81	81.9	112
59.1	60	86	81.9	82.7	113
60	60.8	87	82.7	83.6	114
60.8	61.6	88	83.6	84.4	115
61.6	62.5	89	84.4	85.3	116
62.5	63.3	90	85.3	86.2	117
63.3	64.1	91	86.2	87	118
64.1	65	92	87	87.9	119
65	65.8	93	87.9	88.7	120
65.8	66.6	94	88.7	89.6	121
66.6	67.5	95	89.6	90.4	122
67.5	68.3	96	90.4	91.3	123
68.3	69.2	97	91.3	92.2	124
69.2	70	98	92.2	93	125
70	70.9	99	93	93.9	126
70.9	71.7	100	93.9	94.7	127
71.7	72.5	101	94.7	95.6	128
72.5	73.4	102	95.6	96.5	129
73.4	74.2	103	96.5	97.3	130
74.2	75.1	104	97.3	98.2	131
75.1	75.9	105	98.2	99.1	132
75.9	76.8	106	99.1	99.9	133
76.8	77.6	107	99.9	100.8	134
77.6	78.5	108	100.8	101.7	135
78.5	79.3	109	101.7	102.5	136

Table 1
Number of spares required (Part 4 of 6)

NFT values		Number of spares	NFT values		Number of spares
From	**To**		**From**	**To**	
102.5	103.4	137	126.1	127	164
103.4	104.3	138	127	127.8	165
104.3	105.1	139	127.8	128.7	166
105.1	106	140	128.7	129.6	167
106	106.9	141	129.6	130.5	168
106.9	107.7	142	130.5	131.4	169
107.7	108.6	143	131.4	132.2	170
108.6	109.5	144	132.2	133.1	171
109.5	110.3	145	133.1	134	172
110.3	111.2	146	134	134.9	173
111.2	112.1	147	134.9	135.8	174
112.1	113	148	135.8	136.6	175
113	113.8	149	136.6	137.5	176
113.8	114.7	150	137.5	138.4	177
114.7	115.6	151	138.4	139.3	178
115.6	116.4	152	139.3	140.2	179
116.4	117.3	153	140.2	141.1	180
117.3	118.2	154	141.1	141.9	181
118.2	119.1	155	141.9	142.8	182
119.1	119.9	156	142.8	143.7	183
119.9	120.8	157	143.7	144.6	184
120.8	121.7	158	144.6	145.5	185
121.7	122.6	159	145.5	146.4	186
122.6	123.5	160	146.4	147.3	187
123.5	124.3	161	147.3	148.1	188
124.3	125.2	162	148.1	149	189
125.2	126.1	163	149	149.9	190

Table 1
Number of spares required (Part 5 of 6)

NFT values		Number of spares	NFT values		Number of spares
From	**To**		**From**	**To**	
149.9	150.8	191	174	174.9	218
150.8	151.7	192	174.9	175.8	219
151.7	152.6	193	175.8	176.7	220
152.6	153.5	194	176.7	177.5	221
153.5	154.4	195	177.5	178.4	222
154.4	155.2	196	178.4	179.3	223
155.2	156.1	197	179.3	180.2	224
156.1	157	198	180.2	181.1	225
157	157.9	199	181.1	182	226
157.9	158.8	200	182	182.9	227
158.8	159.7	201	182.9	183.8	228
159.7	160.6	202	183.8	184.7	229
160.6	161.5	203	184.7	185.6	230
161.5	162.4	204	185.6	186.5	231
162.4	163.3	205	186.5	187.4	232
163.3	164.1	206	187.4	188.3	233
164.1	165	207	188.3	189.2	234
165	165.9	208	189.2	190.1	235
165.9	166.8	209	190.1	191	236
166.8	167.7	210	191	191.9	237
167.7	168.6	211	191.9	192.8	238
168.6	169.5	212	192.8	193.7	239
169.5	170.4	213	193.7	194.6	240
170.4	171.3	214	194.6	195.5	241
171.3	172.2	215	195.5	196.4	242
172.2	173.1	216	196.4	197.3	243
173.1	174	217	197.3	198.2	244

Table 1
Number of spares required (Part 6 of 6)

NFT values		Number of spares
From	To	
198.2	199.1	245
199.1	200	246
200	200.9	247
200.9	201.8	248
201.8	202.7	249
202.7	203.6	250
203.6	204.5	251
204.5	205.4	252
205.4	206.3	253
206.3	207.2	254
207.2	208.1	255
208.1	209	256

Failure rates

The following tables list replaceable equipment and provide failure rates for that equipment:

- Table 1modules, and packaging

- Table 2power and cooling equipment

- Table 3circuit cards

- Table 4mass storage (disk drive) equipment

- Table 5station equipment

Note: "N/A" indicates the failure rate is not available at this time.

The failure rates are based on a circuit card ambient temperature of 40 degrees C (104 degrees F). This temperature is usually higher than the surrounding room temperature. Running the system at a lower temperature will increase the life expectancy of components and improve overall system reliability.

There are many cables available from Nortel Networks. The approximate failure rate for most cables, based on failures in time per billion hours (10^9), is 0.5. For a detailed listing of cables, see *Equipment Identification* (553-3001-154).

Table 1
Failure rates of modules, and packaging

Order code	Description	Failure rate per 10^6 hrs
A773056	Fiber Remote Multi-IPE Single-mode (1-4 Superloops)	1.86
A773059	(1-2 Superloops)	
A773054	Fiber Remote Multi-IPE Multi-mode (1-4 Superloops)	1.86
A773055	(1-2 Superloops)	
A0634492	Fiber Remote Multi-IPE Redundant Option, Single-mode	1.86
A0634493	Multi-mode	
NT5D21AA	Core/Network Module AC	0.25
NT5D21DA	Core/Network Module DC	
NT7D00AA	Top Cap (AC)	0.14
NT7D00BA	Top Cap (DC)	
NT8D35AA	Network Module AC	0.90
NT8D35DC	Network Module DC	
NT8D37AA	Intelligent Peripheral Equipment (IPE) Module AC	0.80
NT8D37DC	IPE Module DC	

Table 2
Failure rates of power and cooling equipment

Order code	Description	Failure rate per 10^6 hrs
A0355200	Power Failure Transfer Unit	5.70
NT6D40	PE Power Supply DC	1.60
NT6D41	CE Power Supply DC	0.61
NT8D06	PE Power Supply AC	2.10
NT8D21	Ringing Generator AC	2.02
NT8D22	System Monitor	1.00
NT8D29	CE Power Supply AC	1.27
NT8D52AB	Pedestal Blower Unit AC	2.00
NT8D52DD	Pedestal Blower Unit DC	N/A
NT8D53AB	Power Distribution Unit AC	N/A
NT8D53AD	Power Distribution Unit (option 21A)	N/A
NT8D56AA	CE Module Power Distribution Unit	N/A
NT8D56AC	CE/PE Module Power Distribution Unit	N/A
NT8D57AA	PE Module Power Distribution Unit	N/A
QBL12	Battery Distribution Box	1.33
QBL15	Power Distribution Box	2.81

Table 3
Failure rates of circuit cards (Part 1 of 6)

Order code	Description	Failure rate per 10^6 hrs
NT1P61	Fibre Superloop Network Card	1.05
NT1P62	Fibre Controller Card	1.03
NT1P63	Electro-optical Interface	1.14
NT1R20	Off-Premises Station Analog Line Card	5.00
NT5D03AA	Call Processor Card (48 Mbytes)	N/A
NT5D03BA	Call Processor Card (64 Mbytes)	N/A
NT5D03CA	Call Processor Card (80 Mbytes)	N/A
NT5D03EA	Call Processor Card (112 Mbytes)	N/A
NT5D03FA	Call Processor Card (128 Mbytes)	N/A
NT5D10AA	Call Processor Card (48 Mbytes)	N/A
NT5D10CA	Call Processor Card (64 Mbytes)	N/A
NT5D10EA	Call Processor Card (80 Mbytes)	N/A
NT5D10JA	Call Processor Card (112 Mbytes)	N/A
NT5D11 NT5D14	Line side T1 Line Card	N/A
NT5D12AA	Dual DTI/PRI Card (DDP)	1.76
NT5K02	Flexible Analog Line Card	6.0
NT5K07	Universal Trunk Card for Hong Kong	4.3
NT5K09	Quad Density Receiver	1.5
NT5K10	Enhanced Dual Loop Buffer Card	1.0
NT5K17	Enhanced Dual Loop Buffer Card	1.9
NT5K18	Extended PPM CO Trunk Card	3.5

Table 3
Failure rates of circuit cards (Part 2 of 6)

Order code	Description	Failure rate per 10^6 hrs
NT5K19	E&M/2280 Hz Trunk Card	2.2
NT5K20	Extended Tone Detector	2.2
NT5K21	XMFC/MFE Sender Receiver card	2.7
NT5K36	Direct Inward Dial/Direct Outward Dial Trunk Card for Germany	19.0
NT5K70	Central Office Trunk Card for Germany (8 units)	4.6
NT5K71	Central Office Trunk Card for Germany (4 units)	4.6
NT5K72	E&M Trunk Card for Germany	19.0
NT5K82	Central Office Trunk Card	4.6
NT5K83	E&M Trunk Card for Switzerland	19.0
NT5K83AA	E&M Trunk Card for Denmark	2.5
NT5K83CA	E&M Trunk Card for Norway	2.5
NT5K83DA	E&M Trunk Card for Holland	19.0
NT5K83EA	E&M Trunk Card for Australia	2.5
NT5K84AA	Direct Inward Dial Trunk Card for Switzerland	2.5
NT5K84BA	Direct Inward Dial Trunk Card for Australia	4.6
NT5K93	Central Office Trunk Card for Norway	4.6
NT5K99	Central Office Trunk Card for Spain	4.6
NT5K96	Flexible Analog Line Card without Message Waiting	6.0

Table 3
Failure rates of circuit cards (Part 3 of 6)

Order code	Description	Failure rate per 10^6 hrs
NT6D6003	Core Bus Terminator Card	0.23
NT6D65	Core to Network Interface Card	3.00
NT6D80AA	Multi-purpose Serial Data Link Card	4.47
NT7D16	Data Access Card	4.07
NT7R51	Local Carrier Interface Card	2.40
NT7R52	Remote Carrier Interface Card	1.80
NT8D01AC	Controller-4 Card	7.00
NT8D01BC	Controller-4 Card SMT	1.86
NT8D01AD	Controller-2 Card	6.50
NT8D01BA	Controller-2 Card	1.86
NT8D02	Digital Line Card	1.80
NT8D03	Analog Line Card	5.10
NT8D04BA	Superloop Network Card	2.32
NT8D09	Analog Message Waiting Line Card	5.80
NT8D14	Universal Trunk Card	3.40
NT8D15	E&M Trunk Card	3.70
NT8D16	Digitone Receiver Card	2.70
NT8D17	Conference/TDS Card	5.10
NT8D18	Network/DTR Card	7.30
NT8D41BA	Quad Serial Data Interface Paddle Board	164.0
NT8D72AB	2048 kbps Primary Rate Interface	5.62
NT9D19AA	Call Processor Card (48 MB)	11.95
NT9D19CA	Call Processor Card (64 MB)	12.10

Table 3
Failure rates of circuit cards (Part 4 of 6)

Order code	Description	Failure rate per 10^6 hrs
NT9D19HA	Call Processor Card (96 MB)	12.25
NT9D34	Enhanced Mass Storage Interface Card	2.26
NTAG03	Central Office Trunk Card for Holland	19.0
NTAG04	Central Office/Direct Inward Dial Trunk Card for Holland	19.0
NTAG26	Extended Multi-frequency Receiver	TBD
NTBK51	Downloadable D-Channel Daughterboard	1.24
NTCK16	Generic Central Office Trunk Card	4.6
NTND01	Integrated CPU/Memory Card (6 MB)	5.80
NTND01	Integrated CPU/Memory Card (12 MB)	5.90
QPC43	Peripheral Signaling Card	1.73
QPC71	E&M/DX/Paging Trunk Card	3.10
QPC250	Release Link Trunk Card	7.73
QPC311	Data Line Card (SL-1) — vintage F and later	13.91 8.26
QPC327	MFC Sender/Receiver Card	20.07
QPC343	Ground Button Recall Line Card (A-Law)	12.50
QPC353	Modem Pool Line Card (μ-Law)	8.23
QPC354	Modem Pool Line Card (A-Law)	6.26
QPC397	MCDS Asynchronous Card	12.68
QPC414	Network Card	3.00
QPC422	Tone Detector Card	17.40

Table 3
Failure rates of circuit cards (Part 5 of 6)

Order code	Description	Failure rate per 10^6 hrs
QPC430	Asynchronous Interface Line Card	22.82
QPC432	4-Port Data Line Card	8.15
QPC441	Three-Port Extender Card	2.00
QPC449	Loop Signaling Trunk Card	2.27
QPC450	CO/FX/WATS Trunk Card	3.34
QPC451	SL-1 Line Card	5.15
QPC471	Clock Controller Card — vintage H and later	2.44 1.00
QPC494	500/2500 Message Waiting Card	8.00
QPC526	PPM CO Trunk Card (A-law)	16.82
QPC527	CO/FX/WATS Trunk Card (A-law)	12.37
QPC532	Ground Button Line Card	13.93
QPC540	Tone Detector Card	6.49
QPC574	Digitone Receiver Card	0.83
QPC578	Integrated Services Digital Line Card	2.72
QPC594	500/2500 Line Card	3.70
QPC595	Dual DT Receiver Card (A-law)	6.28
QPC602	ROM Card	3.20

Table 3
Failure rates of circuit cards (Part 6 of 6)

Order code	Description	Failure rate per 10^6 hrs
QPC609	Tone and Digit Switch Card	2.33
QPC628	CO Loop Start Supervisory Trunk Card	7.41
QPC659	Dual Loop Peripheral Buffer Card	2.75
QPC720	Primary Rate Interface Card	6.00
QPC841	Four-Port Serial Data Interface Card	2.30

Table 4
Failure rates of mass storage equipment

Order code	Description	Failure rate per 10^6 hrs
QMM43	Mass Storage Unit	53.59
QMM45	Mass Storage Unit	45.70
QMT102	Disk Drive Controller	3.23
QMT103	Hard Disk Drive	16.31
QMT104	Floppy Disk Drive	22.83
QPC584	Mass Storage Interface Card	2.26
QPC742	Floppy Disk Interface Card	3.23
QUW1	Magnetic Tape Unit	48.00
QUW9	Magnetic Tape Unit	20.58

Table 5
Failure rates of station equipment

Order code	Description	Failure rate per 10^6 hrs
NE-500/2500	500/2500 Telephone	N/A
NE-DGQC-35	Line Cord	3.50
NE-G3AR-35	Handset	0.50
NE-G3DRN-3	Console Handset	0.50
NE-T1	Transmitter	0.50
NE-U1	Receiver	0.50
NTZK06	M2006 Telephone	3.08
NTZK08	M2008 Telephone	3.10
NTZK16	M2616 Telephone	3.88
NTZK20	M2016S Telephone	5.87
NTZK22	M2216ACD-1 Telephone	4.68
NT6G00	M2250 TCM Console	N/A
QMT11	Asynchronous/Synchronous Interface Module	6.34
QMT12	Add-On Data Module	9.92
QPF23	Terminating Plug	0.16

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Meridian 1
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