



Sinneslöschen

SYSTEMS CORPORATION

CLEAR SIGNALS. RELIABLE SYSTEMS.

CUSTOMER TECHNICAL DOCUMENTATION

SSB Termination Requirements

Sinneslöschen System Bus

Document Number: AN-SSB-17
Revision: C
Release Date: July 18, 1996
Supersedes: Revision B, March 4, 1995
Applies To: SSB-1 / SSB-2 / SSB-2E
Distribution: Customer / OEM / Authorized Service

This application note defines approved termination practices for SSB backplanes, extended chassis configurations and selected mixed-generation installations. Improper termination can produce intermittent transfer errors that are difficult to reproduce under static diagnostic conditions.

Sinneslöschen Systems Corporation
1450 Meridian Technology Drive
Sunnyvale, CA 94089 USA
Technical Support: 1-800-555-0142
Documentation Fax: 408-555-0163

Document Control

Purpose. This application note establishes the minimum termination and configuration checks required before an SSB chassis is placed into service or modified in the field. It is intended to complement, not replace, the applicable system service manual.

Revision History

Revision	Date	Summary
A	10.22.93	Initial consolidated note for SSB-2E introduction; superseded earlier SSB-1/SSB-2 field memoranda.
B	03.04.95	Added legacy-module guidance and timing-module interaction for approved mixed-generation systems.
C	07.18.96	Expanded SSB-2E chassis-length tables, clarified endpoint termination, added waveform acceptance guidance and extended-chassis procedures.

Document Conventions

- **MUST / REQUIRED** indicates a condition necessary for an approved configuration.
- **SHOULD / RECOMMENDED** indicates the preferred service practice where configuration-specific instructions do not state otherwise.
- **LEGACY** identifies SSB-1 hardware or earlier system practices maintained only for established installations.
- **ELECTRICAL END** means the physical end of the continuous backplane or interconnect path, not necessarily the first or last numbered chassis slot.

Warning: Termination components are part of the bus electrical design. Substituting a terminator by physical appearance, connector fit or nominal resistance alone is not an approved service method.

Related References

Reference	Use
RM-SSB1-03	SSB-1 System Bus Technical Reference (legacy installations).
TB-95-028	Legacy Timing Notes for selected mixed-generation configurations.
Applicable System Service Manual	Chassis-specific module placement, jumper settings and field change limits.

Contents

Section	Title	Page
1	Introduction and Field Rules	4
2	Electrical Background	5
3	Chassis and Backplane Classification	6
4	Termination Hardware	7
5	SSB-2E Standard Configurations	8
6	SSB-2 Configurations	9
7	SSB-1 Legacy Configurations	10
8	Mixed-Generation Systems	11
9	Extended Chassis and Expansion Interconnects	12
10	Module Position and Stub Control	13
11	Timing Modules and Termination Interaction	14
12	Grounding, Power and Cable Routing	15
13	Waveform Measurement Procedure	16
14	Waveform Acceptance Criteria	17
15	Symptoms and Fault Isolation	18
16	Approved Field Change Procedure	19
17	Worked Configuration Examples	20
18	Field Verification Worksheet	21
A	Quick Reference and Support Escalation	22

Scope Note

The configurations illustrated in this note are representative. When a product-specific service manual identifies a different terminator location, adapter requirement or slot restriction, the product-specific instruction takes precedence.

1 Introduction and Field Rules

SSB is a multidrop backplane interconnect. At the transfer rates used by SSB-2 and SSB-2E, the backplane and attached module stubs must be treated as transmission-line elements rather than as ideal wires. Termination controls the voltage reflections created when an edge reaches an electrical end or an impedance discontinuity.

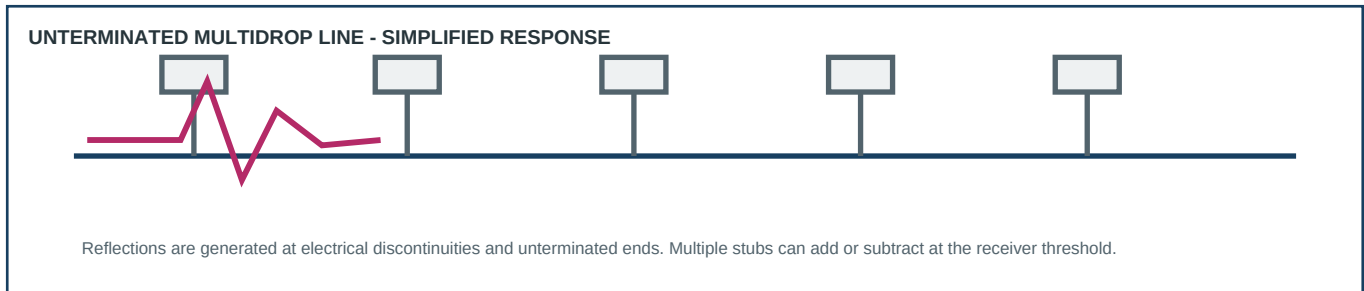


Figure 1-1. Simplified effect of an unterminated bus end.

1.1 Minimum field rules

- Record the complete chassis configuration **before** moving a module, adapter, timing module or terminator.
- Terminate the two electrical ends of one continuous bus segment unless the applicable system documentation explicitly defines an isolated segment.
- Do not install an additional terminator to correct an intermittent fault. Three-point termination can reduce amplitude while masking the original configuration error.
- Do not infer termination from an empty edge slot. Some chassis route the backplane beyond the last accessible module position.
- After any termination change, perform cold-start, enumeration and sustained-transfer tests. A configuration that passes idle diagnostics is not necessarily stable under load.
- Mixed-generation SSB-1 installations require the documented adapter and timing arrangement. Mechanical fit is not proof of electrical compatibility.

1.2 When termination should be investigated

Termination should be considered when a system exhibits load-dependent parity or transfer faults, inconsistent module identification, intermittent startup failures, errors that change with module position, or faults that appear only after adding or removing a board. Power, connector and module failures must still be excluded by normal service procedure.

2 Electrical Background

A switching edge propagating along the SSB backplane encounters the effective characteristic impedance of the loaded chassis. When that edge reaches a discontinuity, a portion of the energy can be reflected toward the source. The magnitude and polarity of the reflection depend on the difference between the line impedance and the terminating impedance.

For service analysis, the reflection coefficient may be considered in simplified form:

$$\Gamma = (Z_L - Z_0) / (Z_L + Z_0)$$

where **ZL** is the impedance presented at the discontinuity and **Z0** is the effective line impedance. The value observed on an installed SSB chassis is influenced by connector loading, module stubs and board capacitance; therefore field technicians should use the approved terminator rather than attempting to calculate a replacement network from an unloaded backplane measurement.

Condition	Typical effect	Service interpretation
Open / missing end terminator	Positive reflection, overshoot, repeated crossings	Most visible on long or lightly loaded chassis; may cause false clock/control edges.
Excess termination	Reduced swing, slow edge, marginal HIGH level	Often caused by an extra interior terminator or incorrect legacy network.
Long module stub	Localized ringing at particular slot/module	Error may follow the module when moved, or disappear when slot position changes.
Poor ground reference	Apparent threshold movement and common-mode noise	Check chassis bonding and power before changing termination.

SIMPLIFIED RECEIVER WAVEFORMS

GOOD



RINGING



SLOW EDGE



Interpret waveform shape together with measured thresholds and the actual loaded chassis configuration; do not approve a system from one point alone.

Figure 2-1. Representative edge shapes: not to scale.

Service note: The objective is not a visually perfect oscilloscope trace. Approval requires adequate voltage margin, controlled overshoot and stable receiver behavior at the specified transfer conditions.

3 Chassis and Backplane Classification

Termination requirements are determined by the electrical path, not by the product name alone. Before selecting a procedure, classify the installation by bus generation, physical backplane length and presence of any expansion interconnect.

Class	Description	Typical service rule
Short single chassis	One continuous backplane up to 8 populated module positions; no external expansion hardware.	Terminate at both electrical ends. Verify interior terminators absent.
Standard single chassis	One continuous backplane, typically 9-14 positions.	Endpoint termination required; inspect edge-slot routing carefully.
Extended single chassis	Long backplane or chassis with more than 14 positions / long unused sections.	Use chassis-specific termination locations and verify waveform at far loaded slots.
Expanded system	Two chassis/backplane sections connected by approved interconnect hardware.	Treat as one path unless the expansion assembly provides documented electrical isolation.
Mixed generation	Any approved combination containing SSB-1 with SSB-2/2E hardware.	Verify adapter, timing module and generation-specific terminator requirements.

3.1 Electrical-end identification

- Trace the backplane or consult the chassis wiring diagram. Numbered slot order is not sufficient.
- Where a backplane folds through a riser or cable, the electrical end is located after the final continuous segment.
- An unpopulated extension section still contributes line length and may require endpoint termination.
- Adapter boards that merely change connector format do not create a new bus segment unless the service manual states that buffering/isolation is present.

3.2 Record before service

Document chassis identification, bus generation, every installed module and revision, slot position, terminator type/location, timing modules, expansion hardware and external cable length. Photographs may be used as supplemental records but should not replace written slot and revision information.

4 Termination Hardware

Sinneslöschen has used several termination implementations across SSB generations. Current and legacy assemblies may be visually similar while presenting different bias and impedance characteristics. Use only the termination type listed for the chassis or approved configuration.

Type	Normal use	Identification / caution
SSB-2E active terminator assembly	Current SSB-2E endpoint termination.	Regulated bias network; normally fitted at both electrical ends. Do not substitute legacy passive
SSB-2 termination assembly	Established SSB-2 systems.	Generation-specific network. Some later field replacements are marked for 2 / 2E compatibility
SSB-1 passive terminator network	Legacy SSB-1 chassis.	Resistor-network implementation varies by chassis revision. Replace only from service document
Integrated backplane terminator	Certain fixed chassis revisions.	May be mounted on backplane and not visible from module side. Never add plug-in terminator
Expansion-end terminator	Approved expanded systems.	Used only at the outer electrical ends of the combined path; do not terminate both sides of an

4.1 Physical inspection

- Confirm part-family marking and revision label; color or connector shell is not sufficient identification.
- Inspect sockets for bent contacts, contamination and evidence of heat damage.
- Check whether the backplane contains a fixed network before installing a plug-in assembly.
- Verify that terminators are seated in the documented endpoint locations and are not one slot inward due to a removed module or blank panel.

4.2 Resistance checks

With power removed and after the specified discharge interval, resistance checks can identify grossly open or duplicated termination. Because installed modules load the bus, measured resistance is configuration-dependent. Use resistance only as a comparison with the service record or a known-good identical chassis; it is not a substitute for configuration verification.

5 SSB-2E Standard Configurations

SSB-2E uses endpoint termination on the continuous backplane. The normal single-chassis arrangement places one approved active terminator at each electrical end. Interior slots remain unterminated unless a product-specific adapter explicitly contains local damping components.

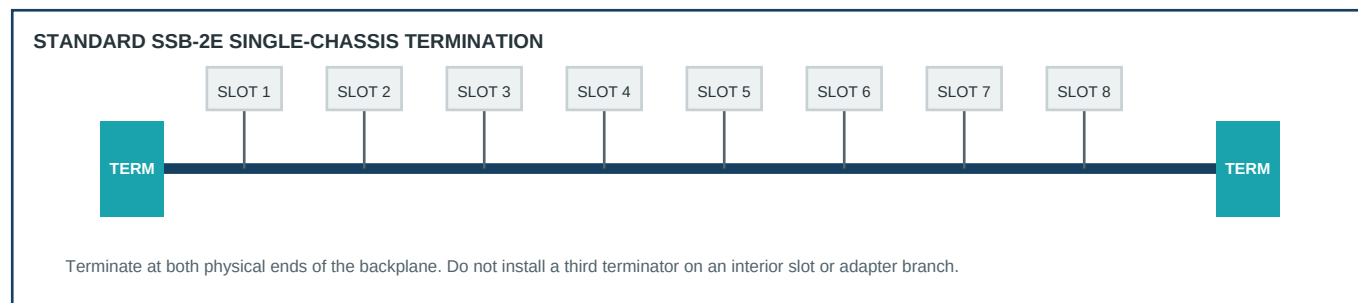


Figure 5-1. Standard SSB-2E endpoint termination.

Configuration	End A	End B	Interior terminators	Disposition
Short / standard chassis	Required	Required	None	Approved
Extended chassis, documented terminator points	Required at documented endpoint	Required at documented endpoint	None	Approved after waveform verification
One end missing	Missing	Present	None	Not approved
Third terminator in interior slot	Present	Present	Present	Not approved
Two terminators both at same end	Two networks	Missing	None	Not approved

5.1 Loading changes

Adding modules increases capacitive loading and can alter edge shape even when termination remains correct. After a substantial loading change, verify cold-start behavior and sustained transfers. If the chassis is near the maximum approved length or module count, use the waveform procedure in Section 13 rather than relocating termination inward.

5.2 Empty edge slots

An empty slot at the physical edge does not authorize moving a terminator to the next populated slot. Termination remains at the electrical end of the backplane. Only a chassis-specific service instruction may define an alternate endpoint connector.

6 SSB-2 Configurations

SSB-2 follows the same endpoint principle as SSB-2E, but approved terminator assemblies and timing margins differ by chassis revision. Do not assume that an SSB-2E active terminator is a universal replacement for every SSB-2 assembly.

Check	Requirement
Generation identification	Confirm chassis/backplane revision before replacement. Chassis exterior labeling may identify the system family rather than the bus revision.
Endpoint count	Exactly two terminations for one continuous unbuffered segment.
Replacement assembly	Use the service-listed SSB-2 assembly or a later assembly explicitly approved for that backplane revision.
Mixed SSB-2 / SSB-2E modules	Allowed only where the module compatibility record permits; termination follows the chassis/backplane electrical revision.
Transfer faults after module addition	Verify slot loading and edge margin before changing termination value or location.

6.1 SSB-2E modules in SSB-2 chassis

A module labeled SSB-2E may support operation in an approved SSB-2 environment, but the module does not convert the chassis to SSB-2E. Chassis termination, arbitration and timing remain those of the installed backplane unless a documented upgrade kit replaces the applicable hardware.

6.2 Historical service changes

Some SSB-2 systems have accumulated field modifications over several service cycles. When the physical configuration does not match the service record, stop and reconcile the installed terminators, adapter boards and timing hardware before replacing electronic modules. Repeated board replacement in a mis-terminated chassis can produce misleading "no fault found" returns.

Recommended verification sequence

- Identify backplane revision and terminator family.
- Verify two endpoint terminators and no undocumented interior terminator.
- Verify module revisions and slot positions.
- Perform cold start and module enumeration.
- Run sustained transfer test on the highest-activity module pair.
- Record final configuration and any waveform measurements.

7 SSB-1 Legacy Configurations

SSB-1 systems remain in service in long-life industrial and OEM installations. Their termination is more dependent on chassis revision and historical component implementation than later SSB generations. Service personnel must preserve the documented legacy configuration unless an approved modernization procedure is available.

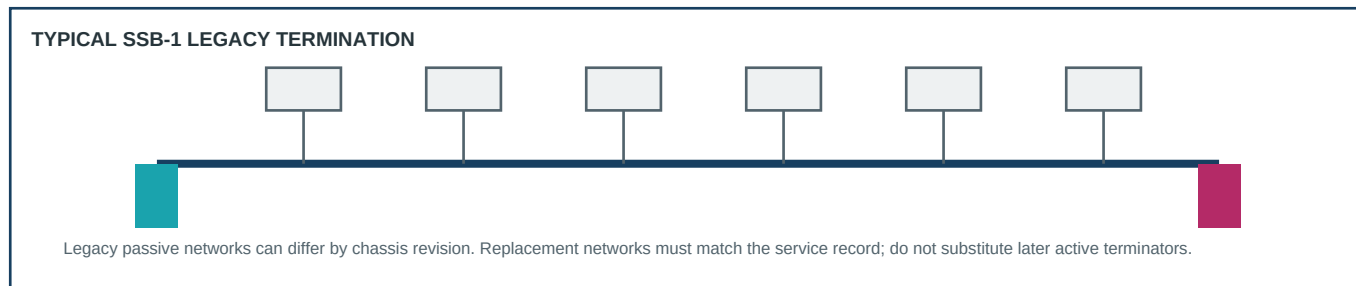


Figure 7-1. Representative SSB-1 legacy endpoint networks.

7.1 Legacy passive networks

SSB-1 commonly uses passive bias/termination networks. Network values and packaging may differ across early chassis revisions. A later active terminator can present an apparently reasonable DC level while altering dynamic loading enough to cause timing or threshold failures.

Condition	Action
Original terminator present and undamaged	Retain; document marking and location before other service.
Terminator missing	Use only the service-listed replacement for the exact chassis/backplane revision.
Unmarked resistor pack fitted	Do not approve configuration until values/origin are established from service records.
System modified for mixed-generation operation	Follow Section 8 and TB-95-028; do not revert individual parts independently.
Intermittent fault disappears with cover removed / probes at suspect	Suspect marginal edge/ground behavior; perform waveform check before module replacement.

Legacy preservation rule: Do not "standardize" an operating SSB-1 chassis by replacing older termination components with newer SSB-2/2E parts unless an approved conversion procedure explicitly requires it.

8 Mixed-Generation Systems

Approved mixed-generation installations allow selected SSB-1 modules to remain in service with later SSB hardware. These configurations rely on a documented combination of compatibility adapter, timing control and endpoint termination. Removing one element because the system appears to operate without it can produce intermittent failures under temperature or load.

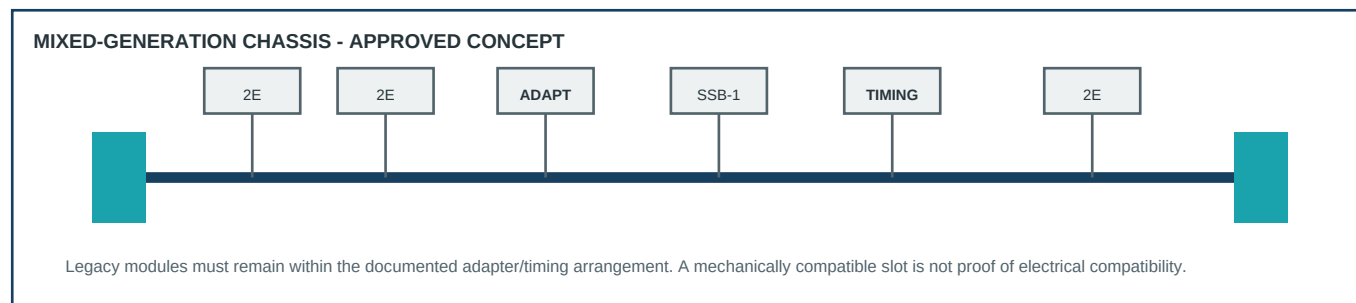


Figure 8-1. Conceptual mixed-generation arrangement. Actual slot positions are system-specific.

Item	Requirement
Compatibility adapter	Required where specified to translate loading, control or connector characteristics.
Timing module	Installed only in the documented slot/range; do not relocate for convenience.
Endpoint terminators	Follow the electrical backplane revision and approved mixed configuration, not the generation printed on an individual module.
Legacy-module position	Observe restricted slot range where stated; long stubs and far-end placement can reduce margin.
Diagnostics	A passed static diagnostic does not waive mixed-generation requirements. Perform sustained-transfer testing after service.

8.1 One-change-at-a-time rule

When correcting a mixed-generation problem, alter only one variable before retesting: terminator, timing module, adapter, module position, or module revision. Simultaneous changes may restore operation without identifying the original fault and can leave an undocumented configuration in service.

8.2 Unsupported combinations

If the installed legacy module or revision is not listed in the applicable compatibility documentation, treat the configuration as unsupported even if it enumerates and appears to operate. Escalate the complete configuration to Technical Support rather than selecting termination empirically.

9 Extended Chassis and Expansion Interconnects

Expansion hardware can increase total bus length and introduce connector/cable discontinuities. Unless the expansion assembly contains documented electrical isolation, the two chassis must be considered one continuous bus for termination purposes.

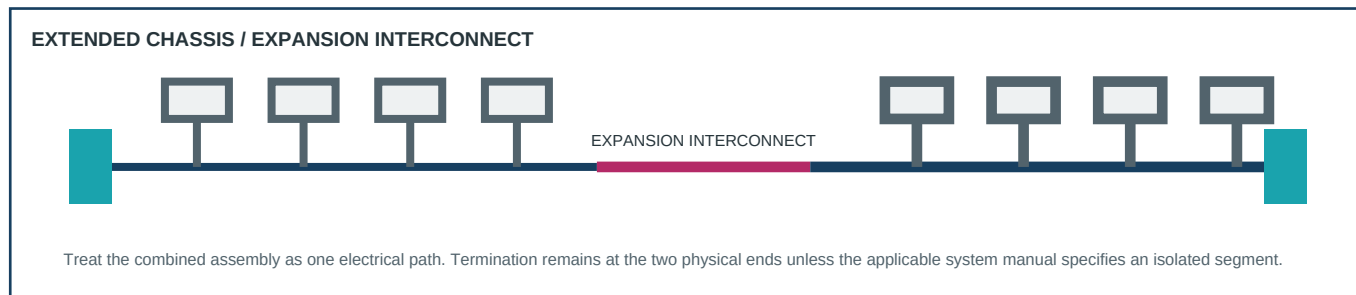


Figure 9-1. Unbuffered expanded system treated as one electrical path.

Configuration feature	Termination rule
Unbuffered chassis-to-chassis interconnect	Terminate only the two outer electrical ends. Do not terminate both sides of the interconnect.
Buffered/isolated expansion assembly	Each isolated segment may require its own endpoint termination as specified by that assembly.
Long external interconnect cable	Use only approved cable type/length. Verify waveform at both chassis ends under sustained transfer.
Unused second chassis left connected	Still part of electrical path; terminate at its far end unless interconnect is removed.
Temporary service extension	Must meet the same termination rules as the permanent configuration.

9.1 Cable handling

- Do not coil excess expansion cable tightly around power transformers or motor leads.
- Do not substitute ribbon, round or shielded cable solely by conductor count.
- Inspect connector retention and shield/bond connections after chassis movement.
- If cable length is changed, repeat waveform and sustained-transfer verification.

9.2 Service isolation

When isolating an expansion chassis for troubleshooting, restore proper termination at the new electrical end before powering the remaining segment. Disconnecting the cable without relocating the required endpoint terminator creates a test condition that may generate additional faults.

10 Module Position and Stub Control

Each module adds a branch, or stub, between the backplane and the receiving circuitry on the board. SSB module designs limit stub length, but adapters, extenders and unauthorized service fixtures can create branches long enough to produce local ringing.

Placement issue	Effect	Approved action
Long service extender installed during normal operation	Adds large stub and connector discontinuity.	Use only for specified static measurements; remove before transfer qualification.
Legacy module at restricted far-end slot	Can combine module stub ringing with endpoint reflection.	Move only to an approved slot defined by mixed-generation documentation.
Empty slots between heavily loaded modules	Generally acceptable; backplane remains continuous.	Do not add interior termination solely because slots are empty.
Module moved to "improve airflow"	May change address, interrupt, loading and timing conditions.	Test as configuration change; verify documentation before relocation.
Adapter stack / piggyback connection	Increases stub and contact count.	Use only approved adapter configuration; no improvised stacking.

10.1 Slot-position records

For field service, the slot map is part of the approved system configuration. Record slot numbers from the chassis markings, not by counting populated boards. If chassis numbering is damaged or ambiguous, photograph the backplane and obtain the wiring diagram before moving hardware.

10.2 Service extenders

A module extender can make an otherwise stable chassis appear defective because the added conductor length increases stub delay and loop area. If an extender is required for measurement, compare the waveform with and without the extender and do not use the extended result as the final system acceptance trace.

10.3 Interior damping components

Some approved interface or compatibility adapters include local series damping. These components are not bus terminators and must not be counted as endpoint termination. Conversely, a board with visible resistor packs should not be assumed to contain bus termination without reference to its schematic or service data.

11 Timing Modules and Termination Interaction

Timing modules used in selected SSB and mixed-generation systems modify bus timing relationships; they do not correct transmission-line termination. A system may require both a timing module and correct endpoint termination. Removing either can produce similar intermittent symptoms.

Observation	Likely area to verify first
Error position changes with bus load but not with clock/timing selection	Termination / module loading / stub behavior.
Error occurs at a repeatable transfer phase and changes when timing module is moved	Timing configuration or prohibited slot placement.
System passes at low activity but fails under block transfer	Termination margin, power distribution, or timing under maximum loading.
Legacy module functions alone but fails with later bus master active	Mixed-generation timing and adapter requirements; also verify endpoint termination.
Waveform amplitude is low at all tested slots	Excess termination or power/ground reference before timing adjustment.

11.1 Do not compensate one fault with another

Changing timing to make a mis-terminated chassis pass is not an approved repair. Likewise, relocating termination inward to sharpen an edge can create an undocumented bus segment. Restore the documented hardware configuration first, then verify timing according to the applicable service procedure.

11.2 Timing-module replacement

- Record part family, revision, jumper/settings and slot location before removal.
- Replace with the same approved revision or an explicitly listed successor.
- Verify endpoint termination independently after replacement.
- Perform startup, enumeration and sustained-transfer tests at normal operating temperature.
- Update the configuration record if an approved revision substitution was made.

12 Grounding, Power and Cable Routing

Bus termination depends on a stable voltage and ground reference. Power or bonding problems can imitate termination faults by moving receiver thresholds, increasing common-mode noise or changing the effective behavior of active termination networks.

Check	Requirement / interpretation
+5 V rail at terminator location	Measure under idle and transfer load. Excess droop can reduce active-terminator margin.
Chassis protective-earth bond	Verify mechanical security and absence of corrosion or painted contact surfaces where bonding hardware requires metal-to-metal contact.
Backplane ground returns	Inspect high-current connectors and fasteners; heat discoloration or intermittent contact requires correction before waveform analysis.
Expansion cable shield/bond	Maintain the specified bond arrangement. Adding an arbitrary ground at both ends can create unintended current paths.
External signal cabling	Keep high-current motor, relay and switching-power cables away from expansion and diagnostic leads where practical.

12.1 Active terminator supply

Where the installed SSB generation uses an active terminator assembly, verify its supply and bias output before replacing the assembly. A correct resistor/impedance measurement with an incorrect bias voltage is not an acceptable condition.

12.2 Probe grounding

Use a short probe ground or approved differential method for edge measurements. A long oscilloscope ground lead can add ringing that is not present at the receiver. Do not attach probe grounds to painted chassis surfaces or distant power-supply terminals when measuring backplane edges.

12.3 Temperature dependence

Marginal termination may appear only after warm-up because driver strength, threshold and power-supply characteristics change with temperature. For intermittent field complaints, repeat the highest-activity transfer after the system reaches normal operating temperature.

13 Waveform Measurement Procedure

Waveform measurement is required when configuration records are incomplete, when an extended chassis is modified, or when load-dependent errors remain after correct terminator hardware and placement have been verified.

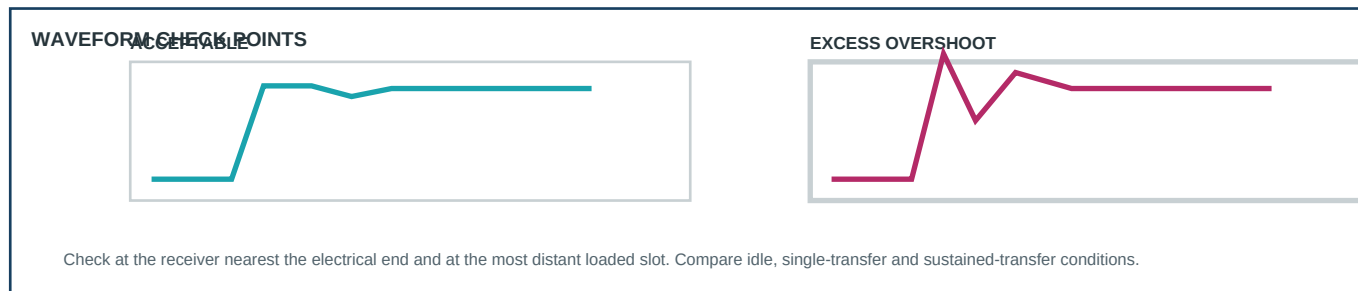


Figure 13-1. Compare near-end and far-end receiver conditions.

Step	Procedure
1	Record bus generation, chassis/backplane revision, module map, terminators, timing modules and expansion hardware.
2	Verify power and chassis grounding. Correct supply or bonding faults before signal analysis.
3	Select a repeatedly active bus signal specified by the service procedure (control/strobe preferred for general checks).
4	Connect a properly compensated probe at the receiver node. Keep ground connection short.
5	Capture idle-to-active transition and sustained-transfer operation. Use normal system loading.
6	Repeat at the receiver nearest one electrical end and at the most distant/highest-loading location.
7	Measure steady LOW/HIGH levels, overshoot/undershoot, edge settling and any repeated threshold crossings.
8	Compare against Section 14 and the product-specific limits. Do not alter termination until the configuration is documented.

13.1 Measurement equipment

Use an oscilloscope and probe with bandwidth sufficient to display the transition without materially loading the bus. A higher-bandwidth instrument is not automatically better if the probe connection introduces excessive capacitance or ground inductance. Service acceptance is based on the installed receiver environment, not on an unloaded connector measurement.

14 Waveform Acceptance Criteria

The following limits are service-screening criteria for supported SSB installations unless the applicable system manual specifies tighter values. They are intended to identify gross termination, loading and grounding problems and should not be treated as semiconductor characterization limits.

Parameter	Preferred service result	Investigate when
Steady LOW level	Below receiver LOW limit with at least 0.4 V margin	Margin less than 0.4 V or level varies significantly with bus load.
Steady HIGH level	Above receiver HIGH limit with at least 0.4 V margin	Margin less than 0.4 V or active terminator bias is unstable.
Positive overshoot	Brief and non-repetitive; settles before next valid sampling interval	Overshoot approaches device absolute limits or causes repeated threshold crossing.
Negative undershoot	Brief; no sustained clamp conduction	Undershoot is repetitive, load-dependent or associated with false transitions.
Settling	One monotonic transition or rapidly damped ringing	Ringing persists into the valid sampling interval.
Edge consistency	Comparable at similar loaded receivers	Large location-to-location difference suggests endpoint/stub/ground issue.

SIMPLIFIED RECEIVER WAVEFORMS

GOOD



RINGING



SLOW EDGE



Interpret waveform shape together with measured thresholds and the actual loaded chassis configuration; do not approve a system from one point alone.

14.1 Threshold crossings

The most important failure indicator is not peak overshoot by itself but whether ringing or slow settling creates an additional receiver threshold crossing during the interval in which the receiving logic can interpret the signal. A visually dramatic spike outside the sampling interval may be less significant than a smaller second crossing near the receiver threshold.

14.2 Record retention

For systems requiring engineering review, retain the configuration worksheet and representative waveform captures with the support case. Identify probe location, signal, operating mode, timebase, vertical scale and whether the system was cold or at normal operating temperature.

15 Symptoms and Fault Isolation

Symptom	Possible termination/configuration cause	First checks
Cold start intermittently misses one or more modules	Missing endpoint termination; marginal active terminator supply; far-end reflection	Verify two endpoints, terminator supply, far-end waveform.
System enumerates correctly but fails sustainably	Timing error simultaneous switching; excess load; long expansion path.	Run transfer while probing far loaded receiver; verify expansion cable/terminators.
Fault changes when board is moved to another slot	Shear slot restriction, address/timing change, edge loading.	Restore original map; check slot restrictions before assuming board fault.
Adding one module destabilizes unrelated hardware	Timing margin or power distribution; third/misplaced terminator.	Verify termination count/location, +5 V at endpoints, module revision.
Errors disappear when service extender is removed	Extender-induced stub and probe loading.	Do not qualify system with extender installed.
Only legacy module fails in mixed system	Adapter/timing/module-position requirement.	Check TB-95-028 and configuration record; verify endpoint termination separately.
Amplitude low across chassis	Extra terminator or active terminator/bias fault.	Count terminators, inspect interior slots, verify terminator supply.
Large overshoot at one end only	Missing/incorrect end terminator or damaged endpoint connector.	Inspect endpoint assembly and backplane continuity.

15.1 Avoid "repair by loading"

Do not leave an otherwise unnecessary module installed because its capacitance appears to suppress ringing. A configuration that relies on incidental loading is not controlled and can fail when that module revision or temperature changes.

15.2 When to stop field troubleshooting

Escalate to Technical Support when the installed configuration cannot be reconciled with documentation, when an unlisted legacy module/adaptor combination is present, when correct endpoint termination still produces repeated threshold crossings, or when repair would require changing terminator component values rather than replacing an approved assembly.

16 Approved Field Change Procedure

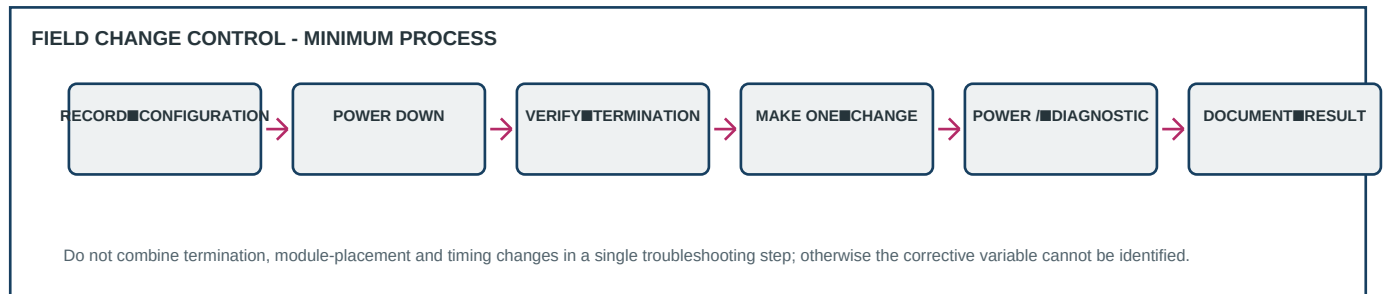


Figure 16-1. Minimum change-control sequence.

- 1. Establish baseline.** Record the complete slot map, revisions, endpoint terminators, timing hardware and expansion components. Record the reported symptom and a reproducible test if possible.
- 2. Power down correctly.** Follow the product service procedure. Observe stored-energy and ESD requirements before handling termination or backplane hardware.
- 3. Verify electrical ends.** Confirm that exactly the required endpoint termination is present and that no undocumented interior terminator exists.
- 4. Make one approved change.** Replace like-for-like, restore documented position, or apply one approved compatibility change. Do not combine speculative changes.
- 5. Inspect before power.** Confirm connector seating, jumper/settings, cable retention and absence of displaced terminator assemblies.
- 6. Cold-start test.** Verify normal initialization and module identification.
- 7. Sustained-load test.** Operate the highest expected bus activity. For expanded or marginal configurations, perform waveform checks.
- 8. Document final state.** Update the service/configuration record, including any approved revision substitutions and measurement results.

16.1 Return to original state

If a change does not correct the symptom, return the system to the recorded baseline before testing a different change unless Technical Support explicitly directs otherwise. Leaving multiple undocumented modifications in place destroys the diagnostic value of subsequent tests.

17 Worked Configuration Examples

Example A - Standard SSB-2E chassis

12-position chassis; nine modules installed; no expansion cable. Approved active terminator at each physical backplane end. Three empty interior slots do not alter termination. **Disposition: APPROVED** after normal startup and sustained-transfer test.

Example B - Extra interior terminator

SSB-2E chassis has correct endpoint terminators plus a third terminator left in an interior slot after a module was removed. System shows low HIGH-level margin under transfer. Remove the interior terminator, restore documented blanking hardware, retest.

Disposition before correction: NOT APPROVED.

Example C - Expanded two-chassis system

Two unbuffered chassis connected by approved expansion interconnect. Terminator present at outer end of Chassis A and outer end of Chassis B. No terminators fitted at the interconnect connectors. Treat as one electrical path; verify far-end waveform after any cable-length change. **Disposition: APPROVED when within cable/length limits.**

Example D - Mixed SSB-1 module

SSB-1 legacy module installed through approved compatibility adapter with documented timing module. Endpoint termination follows the later backplane revision. Legacy module remains in the specified slot range. **Disposition: APPROVED only for the documented module revision and slot arrangement.**

Configuration comparison

Example	Endpoints	Interior termination	Special hardware	Result
A	2	None	None	APPROVED
B	2	1 extra	None	NOT APPROVED
C	2 outer ends	None at interconnect	Expansion cable	CONDITIONAL
D	Per documented later backplane	None unless specified	Adapter + timing module	CONFIGURATION-SPECIFIC

18 Field Verification Worksheet

Use this worksheet when termination is inspected or changed. Attach supplemental slot maps and waveform captures where required.

System / Product:		Serial No.:	
Support Case:		Date:	
Chassis / Backplane Rev.:		SSB Generation:	
Technician:		Location:	

Verification item	Pass	Fail	Notes / identification
Electrical endpoints positively identified			
Correct terminator family at End A			
Correct terminator family at End B			
No undocumented interior terminator			
Timing module / adapter matches record			
Expansion interconnect type/length verified			
Module slot map verified			
Power / ground check completed			
Cold start / module enumeration passed			
Sustained-transfer test passed			
Waveform check required / completed			

Final disposition

APPROVED FOR SERVICE	ENGINEERING REVIEW REQUIRED	NOT APPROVED / RETURN TO BASELINE

Technician signature: _____ Date: _____

Reviewer / customer representative (if required):

Record retention: File this worksheet with the applicable service record. For OEM-controlled systems, follow the customer configuration-control procedure.

Appendix A Quick Reference and Support Escalation

Condition	Quick rule
One continuous SSB-2/2E segment	Two endpoint terminators. No third interior terminator.
SSB-1 legacy chassis	Preserve chassis-specific passive network; do not substitute later active termination without approved conversion.
Unbuffered two-chassis expansion	Terminate the two outer electrical ends of the combined path.
Buffered/isolated expansion	Follow the expansion assembly service documentation; each isolated segment may require its own endpoints.
Mixed SSB-1 with later bus	Requires approved module/revision, adapter/timing arrangement and documented slot placement.
Module moved or added	Treat as configuration change; verify termination remains at physical ends and retest under load.
Waveform marginal after correct hardware verified	Check power/ground, expansion path, module loading and timing; escalate before altering component values.

Escalate to Sinneslöschen Technical Support when:

- the backplane or termination assembly cannot be positively identified;
- the installed configuration differs from all surviving service/configuration records;
- an unlisted SSB-1 module or adapter is present in a later system;
- correct endpoint termination still produces repeated receiver-threshold crossings;
- a field repair would require changing terminator component values or creating a non-standard assembly;
- intermittent errors remain after baseline configuration, power/ground and sustained-transfer checks.

Information to provide

Include product/system model, serial number, chassis/backplane revision, complete module slot map with hardware revisions, terminator identification and location, timing/adapter hardware, expansion-cable information, software/firmware version, support case number if already assigned, and representative waveform captures when available.

North American Technical Support

Telephone	1-800-555-0142
Direct	408-555-0186
Fax	408-555-0127
Documentation Fax	408-555-0163
Hours	Monday-Friday, 6:00 AM-6:00 PM Pacific Time

End of Application Note AN-SSB-17