DIGITAL COMMUNICATIONS ANALYZERS

2850B & 2850BS
2851 & 2851S
2852 & 2852S
2853 & 2853S
2854S & 2855S

Operating Manual

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About this Manual

This manual explains how to use the 2850B & 2851 series of Digital Communications Analyzers.

Intended Audience

Persons engaged on work relating to Digital Communications Systems who have a need to accurately generate, receive and analyze digital signals.

It is assumed that the reader will be familiar with telecommunication terms used in modern communication systems.

Structure

Chapter 1

Introduction and overview

Chapter 2

Installation details

Chapter 3

Manual operation from the front panel including first time usage

Chapter 4

RS-232 and GPIB operation

Chapter 5

Brief technical description

Chapter 6

Instructions for Acceptance testing

Document conventions

The following conventions apply throughout this manual:-

[ENTER]	Hard key titles are indicated by normal lettering in square brackets.
New Value	Messages on the display are shown in Italic letters.
[FRAMED]	Soft key titles are shown in *Italics* in square brackets.

Associated publications

There are three other publications covering specific aspects of this equipment:-

*** Introductory Guide**	(46882/127)	Supplied users guide for in-service and out-of-service applications.
*** Service Manual**	(46880/004)	Optional purchase providing information for maintenance, adjustment, calibration and repair.
*** Operating Manual**	(SKH8354-)M)	Supplied when 2851S Option 23, Data Interface Switch is fitted. Provides user with local and remote operating information.

Contents

Associated publications

	Part no.
Introductory Guide	46882/127
Service Manual	46880/004

Preface

This manual covers 2850B(S), 2851(S), 2852(S), 2853(S), 2854S & 2855S series instruments.

2851 is the standard Digital Communications Analyzer instrument with the facility for fitting Structured Data Option 24.

2850B comprises 2851 without data test interfaces X.21, RS-449, V.35 & RS-232 but with the facility for fitting Structured Data Option 24.

2852 comprises 2851 without data test interfaces X.21, RS-449, V.35 & RS-232 but with unframed error testing extended to 34 Mbit/s and with facility for fitting Mux/Demux - Option 14.

2853 comprises 2851 with unframed error testing extended to 34 Mbit/s and with facility for fitting Mux/Demux - Option 14.

2854S comprises 2851 without data test interfaces X.21, RS-449, V.35 & RS-232 but with framed and unframed error testing extended to 140 Mbit/s with Mux/Demux.

2855S comprises 2851 with framed and unframed error testing extended to 140 Mbit/s with Mux/Demux.

Versions 2851, 2850B, 2852 & 2853 are desktop plastic cased instruments. (2854 & 2855 are not available in this version)

Versions 2851S, 2850BS, 2852S, 2853S, 2854S & 2855S are metal cased, rack mountable instruments.

For brevity reference to 2851 includes all versions unless stated otherwise.

Precautions

WARNING **CAUTION** **Note**

These terms have specific meanings in this manual:

WARNING	information to prevent personal injury.
CAUTION	information to prevent damage to the equipment.
Note	important general information.

Hazard symbols

The meaning of hazard symbols appearing on the equipment and in the documentation is as follows:

Symbol	Nature of hazard
	Refer to the operating manual when this symbol is marked on the instrument. Familiarize yourself with the nature of the hazard and the actions that may have to be taken.
	Dangerous voltage
	Toxic hazard
	Static sensitive component

General conditions of use

This product is designed and tested to comply with the requirements of IEC/EN 61010-1 ‘Safety requirements for electrical equipment for measurement, control and laboratory use’, for Class I portable equipment and is for use in a pollution degree 2 environment. The equipment is designed to operate from an installation category I or II supply.

Equipment should be protected from the ingress of liquids and precipitation such as rain, snow, etc. When moving the instrument from a cold to a hot environment, it is important to allow the temperature of the instrument to stabilise before it is connected to the supply to avoid condensation forming. The instrument must only be operated within the environmental conditions specified in Chapter 1 ‘Performance Data’ in the Operating/Instruction manual.

This product is not approved for use in hazardous atmospheres or medical applications. If the equipment is to be used in a safety-related application, e.g. avionics or military applications, the suitability of the product must be assessed and approved for use by a competent person.

WARNING

Electrical hazards (AC supply voltage)

This equipment conforms with IEC Safety Class I, meaning that it is provided with a protective grounding lead. To maintain this protection the supply lead must always be connected to the source of supply via a socket with a grounded contact.

Be aware that the supply filter contains capacitors that may remain charged after the equipment is disconnected from the supply. Although the stored energy is within the approved safety requirements, a slight shock may be felt if the plug pins are touched immediately after removal.

Do not remove instrument covers as this may result in personal injury. There are no user-serviceable parts inside.

Refer all servicing to qualified personnel. See list of Service Centers at rear of manual.

Fuses - 2850B, 2851, 2852 & 2853

Note that the internal supply fuse is in series with the live conductor of the supply lead. If connection is made to an unpolarized supply socket, it is possible for the fuse to become transposed to the neutral conductor, in which case, parts of the equipment could remain at supply potential even after the fuse has ruptured.

Fuses - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

Note that there are supply fuses in both the live and neutral wires of the supply lead. If only one of these fuses should rupture, certain parts of the equipment could remain at supply potential.

WARNING

Fire Hazard

Make sure that only fuses of the correct rating and type are used for replacement.

If an integrally fused plug is used on the supply lead, ensure that the fuse rating is commensurate with the current requirements of this equipment. See under 'Performance Data' in Chapter 1 for power requirements.

WARNING

Toxic Hazards

Some of the components used in this equipment may include resins and other materials which give off toxic fumes if incinerated. Take appropriate precautions, therefore, in the disposal of these items.

WARNING

Lithium

A Lithium battery (or a Lithium battery contained within an IC) is used in this equipment:

As Lithium is a toxic substance, the battery should in no circumstances be crushed, incinerated or disposed of in normal waste.

Do not attempt to recharge this type of battery. Do not short circuit or force discharge since this might cause the battery to vent, overheat or explode.

WARNING

Nickel Cadmium

A Nickel Cadmium battery is used in this equipment

Do not crush or otherwise mutilate, as corrosive electrolyte can be released. Do not incinerate as this might cause the battery to explode or release toxic fumes.

WARNING

Tilt Facility - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

When the instrument is in the tilt position, it is advisable, for stability reasons, not to stack other instruments on top of it.

CAUTION

Static Sensitive Components

This equipment contains static sensitive components which may be damaged by handling - refer to the Maintenance part of the Service Manual for handling precautions.

CAUTION

Suitability for use

This equipment has been designed and manufactured by Aeroflex for installation and maintenance measurements on data lines and equipment.

If the equipment is not used in a manner specified by Aeroflex, the protection provided by the equipment may be impaired.

Aeroflex has no control over the use of this equipment and cannot be held responsible for events arising from its use other than for its intended purpose.

Precautions

WARNING **CAUTION** **Note**

Les termes suivants ont, dans ce manuel, des significations particulières:

WARNING contient des informations pour éviter toute blessure au personnel.

CAUTION contient des informations pour éviter les dommages aux équipements.

Note contient d'importantes informations d'ordre général.

Symboles Signalant Un Risque

La signification des symboles de danger apparaissant sur l'équipement et dans la documentation est la suivante:

Symbole	Nature du risque
	Reportez-vous au manuel d'utilisation quand ce symbole apparaît sur l'instrument. Familiarisez-vous avec la nature du danger et la conduite à tenir.
	Tension dangereuse
	Danger produits toxiques

Conditions générales d'utilisation

Ce produit a été conçu et testé pour être conforme aux exigences des normes CEI/EN61010-1 « Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire », pour des équipements Classe I portables et pour une utilisation dans un environnement de pollution de niveau 2. Cet équipement est conçu pour fonctionner à partir d’une alimentation de catégorie I ou II.

Cet équipement doit être protégé de l'introduction de liquides ainsi que des précipitations d'eau, de neige, etc... Lorsqu'on transporte cet instrument d'un environnement chaud vers un environnement froid, il est important de laisser l'instrument se stabiliser en température avant de le connecter à une alimentation afin d'éviter toute formation de condensation. L'instrument doit être utilisé uniquement dans les conditions d'environnement spécifiées dans le chapitre 1 « Performances » du manuel d'utilisation.

Ce produit n’est pas garanti pour fonctionner dans des atmosphères dangereuses ou pour un usage médical. Si l'équipement doit être utilisé pour des applications en relation avec la sécurité, par exemple des applications militaires ou aéronautiques, la compatibilité du produit doit être établie et approuvée par une personne compétente.

WARNING

Sécurité électrique (tension d'alimentation alternative)

Cet appareil est protégé conformément à la norme CEI de sécurité Classe 1, c'est-à-dire que sa prise secteur comporte un fil de protection à la terre. Pour maintenir cette protection, le câble d'alimentation doit toujours être branché à la source d'alimentation par l'intermédiaire d'une prise comportant une borne de terre.

Notez que les filtres d'alimentation contiennent des condensateurs qui peuvent encore être chargés lorsque l'appareil est débranché. Bien que l'énergie contenue soit conforme aux exigences de sécurité, il est possible de ressentir un léger choc si l'on touche les bornes sitôt après débranchement.

Ne démontez pas le capot de l'instrument, car ceci peut provoquer des blessures. Il n'y a pas de pièces remplaçables par l'utilisateur à l'intérieur.

Faites effectuer toute réparation par du personnel qualifié. Contacter un des Centres de Maintenance Internationaux dans la liste jointe à la fin du manuel.

Fusibles - 2850B, 2851, 2852 & 2853

Notez que le fusible d'alimentation interne est en série avec la phase du cable d'alimentation. Si la prise d'alimentation est non polarisées, il est possible de connecter le fusible au neutre. Dans ce cas, certaines parties de l'appareil peuvent rester à un certain potentiel même après coupure du fusible.

Fusibles - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

Notez qu'il y a deux fusibles, l'un pour la phase et l'autre pour le neutre du cable d'alimentation. Si un seul fusible est coupé, certaines parties de l'appareil peuvent rester au potentiel d'alimentation.

WARNING

Risque Lie Au Feu

Lors du remplacement des fusibles vérifiez l'exactitude de leur type et de leur valeur.

Si le cable d'alimentation comporte une prise avec fusible intégré, assurez vous que sa valeur est compatible avec les besoins en courant de l'appareil. Pour la consommation, reportez-vous au chapitre 1 "Spécifications".

WARNING

Danger produits toxiques

Certains composants utilisés dans cet appareil peuvent contenir des résines et d'autres matières qui dégagent des fumées toxiques lors de leur incinération. Les précautions d'usages doivent donc être prises lorsqu'on se débarrasse de ce type de composant.

WARNING

Lithium

La batterie utilisée dans cet équipent contient du **Lithium:**

le **Lithium** est une substance toxique; en conséquence on ne doit l'écrase, l'incinérer ou la jeter dans la "poubelle".

Ne pas essayer de la recharger, ne pas la court-circuiter, une forte décharge rapide risque de provoquer une surchauffe voire l'explosion de celle-ci.

WARNING

Nickel Cadmium

Une batterie au **cadmium nickel** est utilisée dans cet équipement.

Ne pas l'écraser ou la broyer, l'électrolyte contenu est corrosif.

Ne pas l'incinérer cela risque de provoquer l'explosion et le dégagement de fumées toxiques.

WARNING

Position Inclinee - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

Lorsque l'appareil est dans une position inclinée, il est recommandé, pour des raisons des stabilité, de ne pas y empiler d'autres appareils.

CAUTION

Utilisation

Cet équipement a été conçu et fabriqué par Aeroflex pour ffectuer des mesures pour l'installation et la maintenance de lignes de données et d'équipements.

La protection de l'équipement peut être altérée s'il n'est pas utilisé dans les conditions spécifiées par Aeroflex.

Aeroflex n'a aucun contrôle sur l'usage de l'instrument, et ne pourra être tenu pour responsable en cas d'événement survenant suite à une utilisation différente de celle prévue.

Vorsichtsmaßnahmen

WARNING **CAUTION** **Note**

Diese Hinweise haben eine bestimmte Bedeutung in diesem Handbuch:

WARNING dienen zur Vermeidung von Verletzungsrisiken.

CAUTION dienen dem Schutz der Geräte.

Note enthalten wichtige Informationen.

Gefahrensymbole

Die Bedeutung der Gefahrensymbole auf den Geräten und in der Dokumentation ist wie folgt:

Symbol	Gefahrenart
	Beziehen Sie sich auf die Bedienungsanleitung wenn das Messgerät mit diesem Symbol markiert ist. Machen Sie sich mit der Art der Gefahr und den Aktionen die getroffen werden müssen bekannt.
	Gefährliche Spannung
	Warnung vor giftigen Substanzen

Allgemeine Hinweise zur Verwendung

Dieses Produkt wurde entsprechend den Anforderungen von IEC/EN61010-1 “Sicherheitsanforderungen für elektrische Ausrüstung für Meßaufgaben, Steuerung und Laborbedarf”, Klasse I, transportabel zur Verwendung in einer Grad 2 verunreinigten Umgebung, entwickelt und getestet. Dieses Gerät ist für Netzversorgung Klasse I oder II zugelassen.

Das Meßgerät sollte vor dem Eindringen von Flüssigkeiten sowie vor Regen, Schnee etc. geschützt werden. Bei Standortänderung von kalter in wärmere Umgebung sollte das Meßgerät wegen der Kondensation erst nach Anpassung an die wärmere Umgebung mit dem Netz verbunden werden. Das Meßgerät darf nur in Umgebungsbedingungen wie in Kapitel 1 "Leistungsdaten (Performance data)" der Bedienungsanleitung beschrieben, betrieben werden.

Dieses Produkt ist nicht für den Einsatz in gefährlicher Umgebung (z.B. Ex-Bereich) und für medizinische Anwendungen geprüft. Sollte das Gerät für den Einsatz in sicherheitsrelevanten Anwendungen wie z.B. im Flugverkehr oder bei militaerischen Anwendungen vorgesehen sein, so ist dieser von einer für diesen Bereich zuständigen Person zu beurteilen und genehmigen.

WARNING

Elektrische Schläge (Wechselspannungsversorgung)

Das Gerät entspricht IEC Sicherheitsklasse 1 mit einem Schutzleiter nach Erde. Das Netzkabel muß stets an eine Steckdose mit Erdkontakt angeschlossen werden.

Filterkondensatoren in der internen Spannungsversorgung können auch nach Unterbrechung der Spannungszuführung noch geladen sein. Obwohl die darin gespeicherte Energie innerhalb der Sicherheitsmargen liegt, kann ein leichter Spannungsschlag bei Berührung kurz nach der Unterbrechung erfolgen.

Öffnen Sie niemals das Gehäuse der Geräte das dies zu ernsthaften Verletzungen führen kann. Es gibt keine vom Anwender austauschbare Teile in diesem Gerät.

Lassen Sie alle Reparaturen durch qualifiziertes Personal durchführen. Eine Liste der Servicestellen finden Sie auf der Rückseite des Handbuches.

Sicherungen- 2850B, 2851, 2852 & 2853

Die interne Sicherung in der Spannungszuführung ist in Reihe mit der spannungsführenden Zuleitung geschaltet. Bei Verbindung mit einer nicht gepolten Steckdose kann die Sicherung in der Masseleitung liegen, so daß auch bei geschmolzener Sicherung Geräteteile immer noch auf Spannungspotential sind.

Sicherungen - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

Es ist zu beachten, daß es Sicherungen in beiden (spannunsführenden und neutralen) Zuleitungen gibt. Wenn nur eine von diesen Sicherungen schmilzt, so bleiben einige Geräteteile immer noch auf Spannungspotential.

WARNING

Feuergefahr

Es dürfen nur Ersatzsicherungen vom gleichen Typ mit den korrekten Spezifikationen entsprechend der Stromaufnahme des Gerätes verwendet werden. Siehe hierzu die Leistungsdaten (Performance Data) in Kapitel 1.

WARNING

Warnung vor giftigen Substanzen

In einigen Bauelementen dieses Geräts können Epoxyharze oder andere Materialien enthalten sein, die im Brandfall giftige Gase erzeugen. Bei der Entsorgung müssen deshalb entsprechende Vorsichtsmaßnahmen getroffen werden.

WARNING

Lithium

Eine **Lithium**-Batterie ist in diesem Gerät eingebaut.

Da Lithium ein giftiges Material ist, sollte es als Sondermüll entsorgt werden.

Diese Batterie darf auf keinen Fall geladen werden. Nicht kurzschließen, da sie dabei überhitzt werden und explodieren kann.

WARNING

Nickel Cadmium

Eine Nickel-Cadmium-Batterie ist in diesem Gerät eingebaut.

Das Gerät nicht beschädigen oder verbrennen, da ätzende Elektrolyte freigesetzt wird. Die Batterie kann dabei explodieren oder giftige Gase freisetzen.

WARNING

Schrägstellung - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

Bei Schrägstellung des Geräts sollten aus Stabilitätsgründen keine anderen Geräte darauf gestellt werden.

CAUTION

Eignung für Gebrauch

Dieses Gerät wurde von Aeroflex entwickelt und hergestellt für Installations- und Wartungsmessungen an Übertragungsleitungen und Ausrüstung durchzuführen.

Sollte das Gerät nicht auf die von Aeroflex vorgesehene Art und Weise verwendet werden, kann die Schutzfunktion des Gerätes beeinträchtigt werden.

Aeroflex hat keinen Einfluß auf die Art der Verwendung und übernimmt keinerlei Verantwortung bei unsachgemässer Handhabung.

Precauzioni

WARNING **CAUTION** **Note**

Questi termini vengono utilizzati in questo manuale con significati specifici:

WARNING riportano informazioni atte ad evitare possibili pericoli alla persona.

CAUTION riportano informazioni per evitare possibili pericoli all'apparec-chiatura.

Note riportano importanti informazioni di carattere generale.

Simboli Di Pericolo

Il significato del simbolo di pericolo riportato sugli strumenti e nella documentazione è il seguente:

Simbolo	Tipo di pericolo
	Fare riferimento al manuale operativo quando questo simbolo è riportato sullo strumento. Rendervi conto della natura del pericolo e delle precauzioni che dovrete prendere.
	Tensione pericolosa
	Pericolo sostanze tossiche

Condizioni generali d'uso.

Questo prodotto è stato progettato e collaudato per rispondere ai requisiti della direttiva IEC/EN61010-1 'Safety requirements for electrical equipment for measurement, control and laboratory use' per apparati di classe I, portatili e per l'uso in un ambiente inquinato di grado 2. L'apparato è stato progettato per essere alimentato da un alimentatore di categoria I o II.

Lo strumento deve essere protetto dal possibile ingresso di liquidi quali, ad es., acqua, pioggia, neve, ecc. Qualora lo strumento venga portato da un ambiente freddo ad uno caldo, è importante lasciare che la temperatura all'interno dello strumento si stabilizzi prima di alimentarlo per evitare formazione di condense. Lo strumento deve essere utilizzato esclusivamente nelle condizioni ambientali descritte nel capitolo 1 'Performance Data' del manuale operativo.

Questo prodotto non è stato approvato per essere usato in ambienti pericolosi o applicazioni medicali. Se lo strumento deve essere usato per applicazioni particolari collegate alla sicurezza (per esempio applicazioni militari o avioniche), occorre che una persona o un istituto competente ne certifichi l'uso.

WARNING

Pericoli da elettricità (alimentazione c.a.)

Quest ’apparato è provvisto del collegamento di protezione di terra e rispetta le norme di sicurezza IEC, classe 1. Per mantenere questa protezione è necessario che il cavo, la spina e la presa d’alimentazione siano tutti provvisti di terra.

Il circuito d’alimentazione contiene dei filtri i cui condensatori possono restare carichi anche dopo aver rimosso l’alimentazione. Sebbene l’energia immagazzinata è entro i limiti di sicurezza, purtuttavia una leggera scossa può essere avvertita toccando i capi della spina subito dopo averla rimossa.

Non rimuovete mai le coperture perché così potreste provocare danni a voi stessi. Non vi sono all’interno parti di interesse all’utilizzatore.

Tutte gli interventi sono di competenza del personale qualificato. Vedi elenco internazionale dei Centri di Assistenza in fondo al manuale.

Fusibili - 2850B, 2851, 2852 & 2853

Notare che un fusibile è posto sul filo caldo del cavo di alimentazione. Se l'alimentazione avviene tramite una presa non polarizzata, è possibile che il fusibile vada a protezione del neutro per cui anche in caso di una sua rottura, l'apparato potrebbe restare sotto tensione.

Fusibili - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

Notare che entrambi i capi del cavo d'alimentazione sono provvisti di fusibili. In caso di rottura di uno solo dei due fusibili, alcune parti dello strumento potrebbero restare sotto tensione.

WARNING

Pericolo D'incendio

Assicurarsi che, in caso di sostituzione, vengano utilizzati solo fusibili della portata e del tipo prescritti.

Se viene usata una spina con fusibili, assicurarsi che questi siano di portata adeguata coi requisiti di alimentazione richiesti dallo strumento. Tali requisiti sono riportati nel cap. 1 "Performance data".

WARNING

Pericolo sostanze tossiche

Alcuni dei componenti usati in questo strumento possono contenere resine o altri materiali che, se bruciati, possono emettere fumi tossici. Prendere quindi le opportune precauzioni nell'uso di tali parti.

WARNING

Litio

Quest'apparato incorpora una batteria al litio o un circuito integrato contenente una batteria al litio.

Poiché il litio è una sostanza tossica, la batteria non deve essere mai né rotta, né incenerita, né gettata tra i normali rifiuti.

Questo tipo di batteria non può essere sottoposto né a ricarica né a corto-circuito o scarica forzata. Queste azioni possono provocare surriscaldamento, fuoriuscita di gas o esplosione della batteria.

WARNING

Nichel cadmio

Quest'apparato incorpora una batteria al nichel cadmio.

Non tentare di rompere o comunque di manomettere la batteria in quanto essa contiene un elettroliti corrosivo. Non incenerire in quanto la batteria può esplodere o emettere dei fumi tossici.

WARNING

Posizionamento Inclinato - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

Quando lo strumento è in posizione inclinata è raccomandato, per motivi di stabilità, non sovrapporre altri strumenti.

CAUTION

Caratteristiche d’uso

Questo strumento è stato progettato e prodotto da Aeroflex installazione, manutenzione e misure su linee di dati e su strumenti

Se lo strumento non è utilizzato nel modo specificato da Aeroflex, le protezioni previste sullo strumento potrebbero risultare inefficaci.

Aeroflex non può avere il controllo sull’uso di questo strumento e non può essere ritenuta responsabile per eventi risultanti da un uso diverso dallo scopo prefisso.

Precauciones

WARNING **CAUTION** **Note**

Estos términos tienen significados específicos en este manual:

WARNING contienen información referente a prevención de daños personales.

CAUTION contienen información referente a prevención de daños en equipos.

Note contienen información general importante.

Símbolos De Peligro

El significado de los símbolos de peligro en el equipo y en la documentación es el siguiente:

Símbolo	Naturaleza del peligro
	Vea el manual de funcionamiento cuando este símbolo aparezca en el instrumento. Familiarícese con la naturaleza del riesgo y con las acciones que deban de tomarse.
	Voltaje peligroso
	Aviso de toxicidad

Condiciones generales de uso

Este producto ha sido diseñado y probado para cumplir los requerimientos de la normativa IEC/EN61010-1 “Requerimientos de la normativa para equipos eléctricos de medida, control y uso en laboratorio”, para equipos clase I, portátiles y para uso en un ambiente con un grado de contaminación 2. El equipo ha sido diseñado para funcionar sobre una instalación de alimentación de categorías I o II.

Debe protegerse el equipo de la entrada de líquidos y precipitaciones como nieve, lluvia, etc. Cuando se traslada el equipo de entorno frío a un entorno caliente, es importante aguardar la estabilización el equipo para evitar la condensación. Sólo debe utilizarse el aparato en las condiciones ambientales especificadas en el capítulo 1 "Especificaciones" o "Performance Data" del Manual de Instrucciones/Manual de Operación/Funcionamiento.

Este producto no ha sido aprobado para su utilización en entornos peligrosos o en aplicaciones médicas. Si se va a utilizar el equipo en una aplicación con implicaciones en cuanto a seguridad, como por ejemplo aplicaciones de aviónica o militares, es preciso que un experto competente en materia de seguridad apruebe su uso.

WARNING

Nivel peligroso de electricidad (tensión de red)

Este equipo cumple las normas IEC Seguridad Clase 1, lo que significa que va provisto de un cable de protección de masa. Para mantener esta protección, el cable de alimentación de red debe de conectarse siempre a una clavija con terminal de masa.

Tenga en cuenta que el filtro de red contiene condensadores que pueden almacenar carga una vez desconectado el equipo. Aunque la energía almacenada está dentro de los requisitos de seguridad, pudiera sentirse una ligera descarga al tocar la clavija de alimentación inmediatamente después de su desconexión de red.

No retire las cubiertas del chasis del instrumento, ya que pudiera resultar dañado personalmente. No existen partes que puedan ser reparadas en su interior.

Deje todas las tareas relativas a reparación a un servicio técnico cualificado. Vea la lista de Centros de Servicios Internacionales en la parte trasera del manual.

Fusibles - 2850B, 2851, 2852 & 2853

Se hace notar que el fusible de alimentación interno está enserie con el activo del cable de alimentación a red. Si la clavija de alimentación de red no tiene polaridad, el fusible puede pasar a estar en serie con el neutro, en cuyo caso existen partes del equipo que permanecerían a tensión de red incluso después de que el fusible haya fundido.

Fusibles - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

Se hace notar que el Equipo está dotado de fusibles tanto en el activo como el neutro de alimentación. Si sólo uno de estos fusibles fundiera, existen partes del equipo que pudieran permanecer a tensión de red.

WARNING

Peligro De Incendio

Asegúrese de utilizar sólo fusibles del tipo y valores especificados como repuesto.

Si se utiliza una clavija con fusible incorporado, asegúrese de que los valores del fusible corresponden a los requeridos por el equipo. Ver sección de especificaciones del capítulo 1 para comprobar los requisitos de alimentación.

WARNING

Aviso de toxicidad

Alguno de los componentes utilizados en este equipo pudieran incluir resinas u otro tipo de materiales que al arder produjeran sustancias tóxicas, Por tanto, tome las debidas precauciones en la manipulación de esas piezas.

WARNING

Litio

En este equipo se utiliza una batería de litio (o contenida dentro de un CI).

Dada que el litio es una substancia tóxica las baterías de este material no deben ser aplastadas, quemadas o arrojadas junto a basuras ordinarias.

No trate de recargar este tipo de baterías. No las cortocircuite o fuerce su descarga ya que puede dar lugar a que la esta emita gases, se recaliente o explote.

WARNING

Niquel Cadmio

En este equipo se utiliza una batería de NiquelCadmio.

No las aplaste o rompa ya que podría liberar electrólito corrosivo.

No las queme ya que podría dar lugar a que la batería explote o libere humos tóxicos.

WARNING

Tener En Cuenta Con El Equipo Inclinado - 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

Si utiliza el equipo en posición inclinada, se recomienda, por razones de estabilidad, no apilar otros equipos encima de él.

CAUTION

Idoneidad de uso

Este equipo ha sido diseñado y fabricado por Aeroflex para medidas en instalación y mantenimiento de equipos y líneas de datos.

Si el equipo fuese utilizado de forma diferente a la especificada por Aeroflex, la protección ofrecida por el equipo pudiera quedar reducida.

Aeroflex no tiene control sobre el uso de este equipo y no puede, por tanto, exigirsele responsabilidades derivadas de una utilización distinta de aquellas para las que ha sido diseñado.

Chapter 1
GENERAL INFORMATION

Contents

Introduction

The 2850B, 2851, 2852, 2853, 2854 and 2855 series Digital Communications Analyzers are combined Data and PCM rate testers.

All provide comprehensive test capabilities for framed and unframed European PCM systems with bit rates up to 8448 kbit/s, extended to 34 Mbit/s (unframed) for 2852 and 2853 and to 140 Mbit/s (framed/unframed) for 2854S and 2855S.

2851, 2853 and 2855S provide comprehensive test capabilities for all commonly used interfaces - RS-232, X.21, RS-449, V.35, codirectional and contradirectional. 2850B, 2852 and 2854S data test capability is limited to codirectional and contradirectional interfaces.

Bit rate options are factory fitted to provide European or hybrid versions and this includes an all bit rate version (European plus North American).

2850B(S) & 2851(S) can be fitted with a Structured Data option providing additional test capabilities for structured and unstructured data via dedicated interfaces.

2852 and 2853 can be fitted with a Mux/Demux option allowing multiplex capability from 64 kbit/s to 34 Mbit/s including insertion of test patterns and demultiplex capability including monitoring of test patterns, framing and alarms.

2854S and 2855S has Mux/Demux capability as a standard fitting and operates from 64 kbit/s to 140 Mbit/s including insertion and monitoring of test patterns and monitoring of framing and alarms.

Optional accessory cables for 2851, 2853 & 2855S allow for alternative combinations of V.11, DTE & DCE and V.10, DTE & DCE.

DC power and Battery power (with charger) options are also available.

2850B, 2851, 2852 & 2853 are fitted with a plastic case suitable for desk top use and have RS-232 remote control capability. (2854 & 2855 are not available in this version).

2850BS, 2851S, 2852S, 2853S, 2854S & 2855S are alternative metal cased instruments suitable for rack mounting and have RS-232 or optional GPIB remote control capability.

Reference to 2851 includes all versions unless stated otherwise.

General features

Local or remote operation

The 2851 can be operated either locally via the front panel keypad with instrument settings and results displayed on an LCD screen or remotely via the RS-232 interface or GPIB (if option is fitted). The software ensures that only allowed measurement parameters and instrument settings can be selected and edited.

Non-volatile stores

At power-down all instrument settings are automatically stored in the non-volatile memory and automatically recalled at power-up.

Up to 18 other sets of instrument settings can also be stored by the user in non-volatile memory so that a particular set of instrument settings can be conveniently recalled when required. In addition, up to a further 18 fixed sets of common instrument settings are also held in non-volatile memory for recall.

All test results over a period of up to 72 hours are automatically stored in non-volatile memory for immediate display and held for later recall until reset by the next test. Test results can also be permanently stored (up to 6 complete sets) in non-volatile memory for later on screen analysis or printing.

Alarm status indicators

Front panel LEDs indicate various signal alarm conditions. These are automatically reset or can be locked on after the alarm clears.

Autoprint

2851 can be programmed to print with an externally connected RS-232 or GPIB printer, all results including histograms on particular events or timed intervals. Autoprint text for event and interval tests can alternatively be stored for later on screen analysis or printing.

Miscellaneous

The LCD has adjustable display angle (for contrast) with a backlight. A buzzer is fitted for optional buzz on detection of an error and/or alarm. A terminal with VDU and keyboard can be connected via the RS-232 port to provide a large additional display of 2851 LCD text under remote control using the VDU and keyboard to emulate 2851 key functions.

Connectors

For 2850B, 2851, 2852 & 2853 all connectors including power, control and test signals are mounted on the rear panel.

For 2850BS, 2851S, 2852S, 2853S, 2854S & 2855S the power, control and auxiliary signals connectors are mounted on the rear panel and all data and PCM test signal connectors are mounted on the front panel.

PCM features

Transmitter and receiver

The receiver and transmitter operate independently.

Line codes

Line codes available:- AMI 50%, HDB3, B6ZS, B8ZS, CMI and NRZ at TTL or ECL level.

Test patterns

The 2851 can receive various test patterns, extracted from one, N, or all channels of a framed signal, or one tributary of a framed signal - if allowed, or from an unframed signal.

Test patterns can be generated by the transmitter for insertion into the same channels/tributaries as for the receiver. Test patterns include pseudo-random bit sequences, fixed and programmable patterns, a digitally encoded sine wave and AIS.

A pattern can be used to fill unused channels in a 2851 generated digital signal.

With option 24, structured data can be generated and received as the test pattern in a PCM signal.

Drop and Insert capability (looped mode)

For in-service testing, live traffic in a selected single or multiple channel of a received digital signal can be dropped out and a test pattern or other signal inserted into it and the channel re-transmitted in the bit stream.

External channel access to the received/transmit bit stream

A 64 kbit/s data stream, or a voice frequency signal can be extracted from the channels of a received framed digital signal or inserted into a channel in a transmitted framed signal. This channel can be one of the channels in a framed signal generated by the 2851 or a channel dropped out from a received digital signal.

The 64 kbit/s data input/output stream can be encoded NRZ, codirectional or contra-directional, X.21, V.35 or RS-449.

The audio signal can be monitored on an internal loudspeaker, and the signal level can be measured and displayed.

Signalling

Decimal and binary equivalents of the signalling code and the last twenty dialled digits are displayed. Parameters associated with dial pulses are user mask programmable so that deviations are displayed as errors. All channels can be monitored simultaneously to search for idle channels.

For framing systems with signalling capability, the signalling bits can be changed. In addition, dialled numbers can be generated to simulate call set-up.

DTMF signalling with tone, dialling generation and monitoring facilities can be selected to provide a more comprehensive test capability.

Access to overhead bits

Overhead bits can be accessed allowing framing strategy testing, simulation of alarms, change and monitoring of auxiliary data. Unused and unassigned bits can also be accessed and displayed.

Unframed NRZ (NON-STD)

Unframed operation using NRZ data and clock, is available from 1 kbit/s to 9 Mbit/s - 2851(S) & 2850B(S) or to 35 Mbit/s - 2852(S) & 2853(S) or to 160 Mbit/s - 2854S & 2855S.

Mux/Demux

2852(S) & 2853(S) with Option 14

Multiplex capability from 64 kbit/s to 34 Mbit/s including insertion of test patterns at 64 kbit/s, n×64 kbit/s, 2048 kbit/s and 8448 kbit/s.

Demultiplex capability including monitoring of test patterns at 64 kbit/s, n×64 kbit/s, 2048 kbit/s and 8448 kbit/s.

Demultiplex monitoring of framing and alarms for each hierarchical level simultaneously.

2854S & 2855S

Multiplex capability from 64 kbit/s to 140 Mbit/s including insertion of test patterns at 64 kbit/s, n×64 kbit/s, 2048 kbit/s, 8448 kbit/s and 34368 kbit/s.

Demultiplex capability including monitoring of test patterns at 64 kbit/s, n×64 kbit/s, 2048 kbit/s, 8448 kbit/s and 34368 kbit/s.

Demultiplex monitoring of framing and alarms for each hierarchical level simultaneously.

Receiver

Test measurements

The receiver can be set to simultaneously measure parameters associated with Line code errors (Bipolar violations), Pattern errors, Framing errors and CRC errors. These include number of errors and long term mean error ratio. For pattern errors within a single 64 kbit/s channel the number of positive and negative octet slips are also measured.

More detailed analysis is made on one of these error types. These include a histogram displaying error distribution over 72 hours with indicators for loss of synchronization and power, current error ratio, residual error ratio, burst measurements and error performance measurements to G.821, G.826, G.921 and M.2100. G.821 analysis is further enhanced by G.821/G.921 histograms (of up to 100 hours or 100 days) with programmable intervals and limits.

Input modes

The receiver has three input modes:- Terminated for direct termination of the line, Bridging for directly monitoring a terminated line and Monitoring for monitoring a terminated line at a protected monitor point. Automatic line build out (ALBO) is available for 2048 kbit/s systems (Option 01 but not when Option 04 is fitted).

Digital signal level

The peak amplitude of the incoming digital line signal is displayed in Volts and dB relative to nominal.

2 Channel sync slips

Two primary rate digital signals can be compared for frequency synchronization, thereby assisting in isolating network clocking problems.

Network propagation delay measurement

Delay measurements on data circuits can be made to a high level of accuracy providing valuable information about satellite links where high values of delay are experienced and need to be measured. Also useful in characterising networks to assist in finding unwanted loopbacks.

Errors output signal

Depending on the error type selected by the user, a pulse is output for either a detected code, pattern, frame or CRC error.

Transmitter

Error injection

Errors can be injected into Framing Bits, Pattern Bits or CRC Bits if applicable and can be either bit errors or bipolar violations. For systems with CRC capability, as well as injecting into CRC Bits, errors can be injected into the test signal either before or after CRC is calculated. Errors can be injected either singly or in bursts either by keypress as a single shot or automatically at a set rate. For CRC systems, when injecting at a set rate, the CRC block error rate can be specified.

Errors can also be injected into live traffic channels within 2048 kbit/s signals by using Drop & Insert mode. This is useful for determining the tolerance of live systems to errors.

Clock output and source

The clock source can be internal, external or derived from the received signal. A square wave clock output is available at the bit rate when the 2851 uses its own clock.

Remote loopback (1544 kbit/s systems)

Two pairs of user defined patterns can be generated to establish and clear down a remote loopback link for loopback testing.

Data features

Transmitter and receiver

Test patterns

The instrument can receive and transmit various data test patterns for any of the commonly used data test interfaces.

Modes

Both synchronous and asynchronous modes are possible with a wide range of standard and user programmable data rates.

Remote loopback

Remote loop activation and deactivation is provided for the RS-232 interface according to CCITT Rec. V.54 by means of control lines.

Receiver

Network propagation delay measurement

Delay measurements on data circuits can be made to a high level of accuracy providing valuable information about satellite links where high values of delay are experienced and need to be measured. Also useful in characterising networks to assist in finding unwanted loopbacks.

Transmitter

Error injection

Errors can be injected into Pattern Bits singly either by keypress as a single shot or automatically at a set rate.

Structured Data features

Transmitter and receiver

The instrument generates and receives X.50 structured signals at 64 kbit/s. Input and output signals are either channels within 2 Mbit/s systems or via 64 kbit/s dedicated 120 Ω, V.11 or TTL interfaces. The transmitter and receiver operate independently.

Line codes

Line codes available at 64 kbit/s are: NRZ, codirectional, contradirectional, AMI 50% & 100%, biphase mark & space.

Test patterns

The instrument can receive various test patterns, extracted from an X.50 structured 80 channel or 20 channel signal, or a 6 + 2 reiterated data signal.

Test patterns can be generated by the transmitter for insertion into the same channels as for the receiver. Test patterns include pseudo random bit sequences, fixed and programmable patterns and AIS.

The structured data signal containing the test pattern can also be inserted into the channel of a PCM signal or extracted from a received PCM signal.

A pattern can also be selected to fill unused channels in an X.50 structured generated signal

Receiver

Test measurements

The receiver can be set to measure simultaneously parameters associated with Pattern errors and Framing errors. These include number of errors and error ratio.

More detailed analysis is made on one of these error types. These include a histogram displaying error distribution over 72 hours with indicators for loss of synchronisation and power, current error ratio and error performance measurements to G.821.

Signal inputs

The receiver can be set to receive TTL or balanced V.11 or balanced 120 Ω signals. The received bit rate is measured and displayed.

Transmitter

Error injection

Bit errors can be injected into Pattern bits, Framing bits and Envelope bits or user specified bits. Errors can be injected singly by keypress as a single shot or automatically at a set rate.

Errors can also be injected into live traffic channels within a structured data system by using the Drop & Insert mode.

Clock output and source

The clock source can be internal, external or derived from the received signal. A square wave clock output is available at the bit rate when the clock source is internal.

Drop and insert capability

Live traffic in a selected channel of an 80 channel or 20 channel signal can be dropped out and a test pattern inserted into it and the channel retransmitted in the bit stream.

Remote loopback

Loopback patterns for BT, SIP or DER modes can be generated to establish and clear down a remote loopback link for loopback testing.

Performance data
2850B & BS / 2851 & S

PCM TRANSMIT INTERFACE

Framing and bit rate	Signals can be transmitted unframed or with the frame structure indicated.	
Enabling option	See table at end of specification.	
03, 04	704 kbit/s	10 Channel System.
02, 04	1544 kbit/s 1544 kbit/s 1544 kbit/s 1544 kbit/s 1544 kbit/s	T1. T1 no signalling. T1ESF. T1ESF no signalling. T1DM, DDS Data Mux.
01	2048 kbit/s 2048 kbit/s 2048 kbit/s 2048 kbit/s 2048 kbit/s	G.704. G.704 no multiframe. G.704 with CRC. G.704 with CRC, no multiframe. 32 frame multiframe.
04	3152 kbit/s 3152 kbit/s	DS1C mode 1 synchronous. DS1C mode 2 synchronous.
04	6312 kbit/s 6312 kbit/s 6312 kbit/s	DS2 96 channels synchronous. DS2 asynchronous. 2048 kbit/s interworking to G.747.
01	8448 kbit/s 8448 kbit/s 8448 kbit/s 8448 kbit/s	G.742 asynchronous. G.745 asynchronous. G.704/741 synchronous. G.704/744, 120 channels, synchronous.
01, 25	256 kbit/s 512 kbit/s 1024 kbit/s	Eurocom D/1 IB5
Permitted combinations of bit rates	2048 & 8448 kbit/s or 704 & 2048 & 8448 kbit/s or 256 & 512 & 1024 & 704 & 2048 & 8448 kbit/s or 1544 & 2048 & 8448 kbit/s or 1544 & 3153 & 6312 kbit/s or 704 & 2048 & 8448 & 1544 & 3152 & 6312 kbit/s.	
AIS	All ones signal with zeros programmable at a rate of M $\times$ 10^{-N}, where M is 1-9 and N is 2-7.	
Clock source	Internal, external or derived from the received signal.	
Internal		
Accuracy	±5 ppm from 0°C to 55°C. ±3 ppm/year.	
Small Offset	Steps of 5 and 25 ppm to maximum of ±150 ppm.	
Large Offset		
Up to 2.5 MHz	Steps of 2 kHz to maximum of ±96 kHz.	
Over 2.5 MHz	Steps of 8 kHz to maximum of ±96 kHz.	
External		
Range	1 kHz to 9 MHz.	
Level	TTL square wave. In accordance with G.703, Figure 21.	
Impedance	1000 Ω.	
Connector	BNC.	
Clock output	TTL via 50 Ω.	
Line codes	AMI (50% duty cycle) HDB3 B8ZS B6ZS NRZ (TTL level).	
Non standard	Unframed only.	
Clock		
Internal. External.		

Range	1 kbit/s to 11 Mbit/s.
Steps	1 bit/s.
Line Code	NRZ.
Level (data and clock)	TTL.
Connector	Auxiliary connector, 25 way D-type (for pinout see end of specification).
Test patterns	
Insertion	
Single Channel	Selected 64 kbit/s channel of framed signal.
n x 64 kbit/s Channel	Selected n x 64 kbit/s channel of framed signal. Channel distribution can be contiguous or non-contiguous.
Framed	All channels of framed signal.
Unframed	Unframed signal.
PRBS	$2^{9} - 1$. $2^{11} - 1$. $2^{15} - 1$. $2^{20} - 1$. Optional maximum 14 or 7 successive 0 limitations for 1544 and 3152 kbit/s systems.
Sense	True or inverted.
Mode (framed only)	
8 bit	PRBS data fills all 8 bits in an octet.
7 + 1 bit	First 7 bits are PRBS data and last bit is a 1.
All zeros	Continuous sequence of 0000.
All ones	Continuous sequence of 1111.
Alternating	Alternating sequence of 1010.
16 bit word	User programmable sequence of 16 bits.
8 + 8 word	Two user programmable 8 bit sequences are alternated by an external TTL input. The changeover occurs at the end of 8 bits.
1 kHz 0 dBm0 sine wave	Digital representation of a sinusoidal signal of 1 kHz at a nominal level of 0 dBm0, coded according to A-Law, inserted into single channel. This facility is not available for 1544 kbit/s systems.
Fill patterns	In single channel framed operation the following patterns are used to fill all other channels.
PRBS	$2^{15} - 1$.
8 bit word	User programmable sequence of 8 bits.
External voice/data	For framed operation, an externally input 64 kbit/s data stream or a voice frequency signal can be inserted into one of the channels in the transmitted signal instead of a test pattern.
Data input	Applies only to frame structures at 704, 1544, 2048 and 8448 kbit/s (G.704/G.744).
Data Input Interface	Codirectional to G.703. Contradirectional to G.703 (AMI 100% or Bipolar NRZ). X.21, V.35, RS-449 (using DCE cable adapter accessory). NRZ (TTL level).
Voice frequency input	Applies only to 1544 and 2048 kbit/s systems.
Range	0.3 to 3.4 kHz.
Encoding	A-Law for 2048 kbit/s. μ-Law for 1544 kbit/s.
Impedance	600 Ω balanced.
Max Input Level	+3 dBm0.
Drop & insert	For framed operation the received signal is looped to the transmitter. Note that for CRC frame structures the CRC is recalculated before retransmission.
64 kbit/s	A selected 64 kbit/s channel is replaced by a test pattern or by an externally input digital signal.
Audio	A selected 64 kbit/s channel is replaced by an externally input voice frequency signal (as above).
n x 64 kbit/s	A selected n x 64 kbit/s channel is replaced by a test pattern. The channel selection can be contiguous or non-contiguous.
Error injection	
Target	Test Pattern Only. Framing Only. CRC Only. Traffic (Drop and Insert Mode).
Error Type	
Binary	Bits are inverted before coding.

Code	Code errors are injected by changing ±1 to 0 and 0 to ±1 where the polarity of the inserted mark is the same as the polarity of the last mark transmitted.
Injection Mode	
Singly	By keypress.
Fixed rate	Rate 3 x 10^{-1} to 1 x 10^{-7}.
In bursts	Pseudo Random Burst with user selectable burst length of 8, 16, 32, 64, 128, 256 errors. The actual transmitted error ratio with bursts at a fixed rate is fixed rate x the number of errors in the burst, e.g. a burst length of 16 at a rate of 2 x 10^{-6} will measure 3.2 x 10^{-5}. Bursts may not stay confined to the designated target type.
CRC Block Errors	To CCITT Recommendation G.96Y.
Range	1-999 errored blocks in 1,000 or 60,000 blocks.
Threshold presets	Programmable presets for Severely Errored Seconds, Degraded Minutes and Errored Seconds thresholds.
Main outputs	
Balanced	
Impedance	120 Ω
Peak Voltage	3 V ±0.3 V
Space Voltage	0 V ±0.3 V.
Unbalanced	
Impedance	75 Ω
Peak Voltage	2.37 V ±0.237 V.
Space Voltage	0 V ±0.237 V.
NRZ	TTL.
Data interface	
X.21, RS-449, V.35	
(see Data Test Interface section for specification)	
Signalling bit control	For framing systems with Channel Associated Signalling capability: The signalling bits can be changed. Dialled numbers up to 20 digits can be generated.
DTMF signalling	See Measurements Section.
C-bit framing	Generation of C-Bit Frame for French TRANSMIC-2G System. Control of C-Bit Frame message bits.
Access to structure bits	The following tests are available, depending on the framing system selected: - Frame alignment strategy. - Multiframe alignment strategy. - Change unassigned, distant, distant multiframe and alarm bits. - Change Auxiliary Data Bits (T1 systems). - Send BELL Yellow Alarm: Bit 2 suppression (T1SF). Facility Data Link message (T1ESF).
Loopback (T1 systems only)	Activates and deactivates automatic remote loop equipment. 4 loopback codes, each of 3-16 bits (2 loopup and 2 loopdown) can be user programmed and stored in non-volatile memory for subsequent use.
Sync outputs	PRBS.
Polarity	Negative pulse.
Interface	TTL.

PCM RECEIVE INTERFACE

Framing and bit rates	Signals can be received unframed or with the frame structure indicated. As Transmitter plus 1544 kbit/s - T1SLC96 (synchronisation and channel access).
Permitted combinations of bit rates	As Transmitter.
Frequency Tolerance	
256 kbit/s	±60 ppm
512 kbit/s	±60 ppm
1024 kbit/s	±60 ppm
704 kbit/s	±50 ppm.

1544 kbit/s	±130 ppm.
2048 kbit/s	±50 ppm.
3152 kbit/s	±30 ppm.
6312 kbit/s	±33 ppm.
8448 kbit/s	±30 ppm.
Line codes	As Transmitter.
Non standard	Unframed only.
Clock	External.
Range	1 kbit/s to 11 Mbit/s.
Line Code	NRZ.
Level (data and clock)	TTL.
Connector	Auxiliary connector, 25 way D-type (see end of specification for pinout).
Input modes and sensitivity	
Modes	
Terminated	Terminates the line.
Bridging	Taps onto a terminated line or unprotected monitor point.
Monitoring	Connects to a protected monitor point.
Automatic Line Equalisation	Automatic Line Equalisation (Automatic Line Buildout, ALBO) is provided at 2048 kbit/s for Option 01 (except when Option 04 fitted).

Balanced

	Terminated		Bridging	
Impedance	120 Ω		>1000 Ω	
Level				
Normal	3 V	+2 –6 dB	3 V	+2 –6 dB
ALBO	3 V	–3 –30 dB	3 V	–3 –30 dB

Unbalanced

	Terminated		Bridging	
Impedance	75 Ω		>1000 Ω	
Level				
Normal	2.37 V	+2 –6 dB	2.37 V	+2 –6 dB
ALBO	2.37 V	–3 –30 dB	2.37 V	–3 –30 dB

Balanced

	Monitor (–30 dB)		Monitor (–20 dB)	
Impedance	120 Ω (3000 Ω)		120 Ω (1000 Ω)	
Level				
Normal	115 mV	+2 –6 dB	300 mV	+2 –6 dB

Unbalanced

	Monitor (–30 dB)		Monitor (–20 dB)	
Impedance	75 Ω (2400 Ω)		75 Ω (680 Ω)	
Level				
Normal	75 mV	+2 –6 dB	237 mV	+2 –6 dB

Data interface
X.21, RS-449, V.35
(see Data Test Interface section for specification

Test patterns

Source	Selected channel of framed signal. All channels of framed signal. Unframed signal.
PRBS	$2^9 - 1$. $2^{11} - 1$. $2^{15} - 1$. $2^{20} - 1$. Optional max 14 or 7 successive 0 limitation for 1544 and 3152 kbit/s systems.
Sense	True or inverted.
Mode (framed only).	
8 bit	PRBS data fills all 8 bits in an octet.
7 + 1 bit	First 7 bits are PRBS and last bit is a 1.
Repetitive Word	Any word which repeats over a 16 bit sequence.
Pattern synchronisation	
Loss Criterion	
PRBS	Error rate greater than 1 in 5 for each of 10 consecutive deciseconds (1 in 10 above 5 Mbit/s)
16 bit word	Error rate greater than 1 in 20 for each of 10 consecutive deciseconds.
Async Message	Error rate greater than 1 in 20 for each of 10 consecutive deciseconds.
Channel extract	For framed single channel operation a selected 64 kbit/s channel is extracted from the received signal and output as a data signal or voice frequency signal. The audio output is also available on the internal loudspeaker.
Data Output	Applies only to the frame structures at 704, 1544, 2048 and 8448 kbit/s (G.704/G.744).
Data Output Interface	Codirectional to G.703. Contradirectional to G.703 (100% AMI or Bipolar NRZ). X.21, V.35, RS-449 (using DCE cable adapter accessory). NRZ (TTL level).
Frame or AIS alarm detected	All 1's transmitted.
Signal loss detected	Outputs are off.
Clock output	64 kHz NRZ (TTL).
Voice Frequency Output	1544 and 2048 kbit/s systems only.
Range	0.3 to 3.4 kHz.
Decoding	A-Law for 2048 kbit/s. μ-Law for 1544 kbit/s.
Impedance	600 Ω balanced.
Status indicators	LEDs indicate frame structure alarm conditions.
Display modes	
AUTO RESET	LEDs show current condition and extinguish when the alarm condition clears. LEDs are ON for the length of time an alarm condition exists with a minimum of 1 sec.
LAMP LOCK	LEDs remain ON after alarm clears.
LINE	ON indicates signal loss.

AIS	ON indicates signal is all 1's. All 1's is defined as signal with less than three zeros in two frame periods.
FRAME	ON indicates a loss of frame alignment.
ERRORS	ON indicates that the error rate of the major error type is greater than a threshold set by the user. Threshold is 1 x 10^{-9} to 9 x 10^{-3}.
MF/ZEROS	
ON indicates:	Loss of multiframe alignment (2048 kbit/s). More than 31 consecutive zeros have been received (1544 kbit/s).
DIST/YELLOW	
ON indicates:	Distant alarm (2048 kbit/s). Yellow Alarm (1544 kbit/s).
DMF	
ON indicates:	Distant multiframe alarm (2048 kbit/s). ISDN error report alarm (2048 kbit/s systems for ISDN applications).
PATTERN	ON indicates loss of pattern synchronisation.
REMOTE	ON indicates the instrument is under remote control and the keyboard is inoperative.
RX: CRC UNSYNC	Loss of C-Bit framing sequence synchronisation.
Alarm extension	An output is provided corresponding to an alarm condition.
Polarity	Positive for alarm.
Interface	TTL.
Errors output	An output pulse is provided for each code error, pattern error, frame error, or CRC error (as selected to be the main measurement - see measurements section) (Pin 16 of auxiliary connector).
Interface	TTL.
Pulse Width	50% of bit interval.3
Unassigned framing bits	The state of the unassigned bits is displayed. Applies to 704, 2048 and 8448 kbit/s systems.
ISDN error report bits (to CCITT Rec. G.96Y)	Applies to 2048 kbit/s CRC system with no signalling multiframe, to G.704.
Bits monitored	Bits 4, 5, 6, 7 and 8 in Not Frame Word.
Function	Detects, displays and Autoprints occurrence of valid error alarm pulses within bits 6, 7 and 8 corresponding to Severely Errored Seconds, Degraded Minutes and Errored Seconds, and their relation to the CRC multiframe, in frame pairs. Alarm pulses can be latched. Bits 4 and 5 are displayed. Changes in the state of bit 5 are Autoprinted.
ISDN error report bits	Applies to 2048 kbit/s system with no signalling multiframe, to G.704.
Bits monitored	Bits 4, 5, 6, 7 and 8 in Not Frame Word.
Function	Detects, displays and Autoprints occurrence of valid error alarms within bits 6, 7 and 8 corresponding to Severely Errored Seconds, Degraded Minutes and Errored Seconds. Four sets of bits 6, 7 and 8 are displayed corresponding to the four combinations of bits 4 and 5 (00, 01, 10 and 11, each of which exists for 250 ms each second). Alarm pulses can be latched.
Sync outputs	PRBS
Polarity	Negative pulse.
Interface	TTL.

DATA TEST INTERFACES

X.21 (X.24), RS-449 (V.36), V.35 and RS-232	2851 and 2851S only.
X.21 (X24), RS-449 (V.36), V.35	X.21 (V.11), RS-449 (V.11) and V.35 circuits are presented to a common connector. DTE interfaces are provided by supplied cables which provide the appropriate connector and electrical interface. A series of optional cables provide alternative combinations of V.10, DTE and DCE.
Connector (instrument)	50 way type 57 female.
Cable Connectors	
X.21	15 way D-Type, ISO 4903 female.

RS-449 (V.36)	37 way D-Type, ISO 4902 female.
V.35	34 way MRAC, ISO 2593 female.
Cable recognition	Automatic recognition of the cable type plugged in.
RS-232	Dedicated interface, DTE, DCE provided by means of optional cable.
Connector	25 way D-Type female, ISO 2110.

Pin connections

X.21 - DTE/DCE

Pins	From DTE (To DCE)	Circuit	Pins	To DTE (From DCE)	Circuit
2, 9	Transmit	T	4, 11	Receive	R
3, 10	Control	C	6, 13	Timing	S
8	Ground		5, 12	Indication	I

- For unbalanced operation the second pin of each pair is earth.

RS-449 (V.36) - DTE/DCE

Pins	From DTE (To DCE)	Circuit	Pins	To DTE (From DCE)	Circuit
4, 22	SD Send Data	103	6, 24	RD Receive Data	104
17, 35	TT Tx Timing	113	8, 26	RT Rx Timing	115
19	Signal Ground		5, 23	ST Send Timing	114
7, 25	RS (RTS)	105	9, 27	SC (CTS)	106
12, 30	DTR	108/2	11, 29	DSR	107

- For unbalanced operation the second pin of each pair is earth.
- DTR present on DTE cable option but not monitored on DCE cable option
- DSR present on DCE cable option but not monitored on DTE cable option

V.35 - DTE/DCE

Pins	From DTE (To DCE)	Circuit	Pins	To DTE (From DCE)	Circuit
P, S	Transmit data	103	R, T	Receive data	104
U, W	Transmit timing	113	V, X	Receive timing	115
B	Signal Ground		Y, AA	Transmit timing	114
C	Request to send	105	D	Clear to send	106
H	DTR	108/2	E	DSR	107

- DTR present on DTE cable option but not monitored on DCE cable option
- DSR present on DCE cable option but not monitored on DTE cable option

RS-232 - DTE/DCE

Pins	From DTE (To DCE)	Circuit	Pins	To DTE (From DCE)	Circuit
2	Transmit data	103	3	Receive data	104
24	Transmit timing	113	17	Receive timing	115
4	Request to send	105	15	Transmit timing	114
20	Data terminal ready	108	5	Clear to send	106
18	Local loop	141	6	Data set to ready	107
21	Remote loop	140	8	Receive line signal detect	109
7, 1	Ground		25	Test mode	142

Control Lines

X.21

DTE	DCE	
I (Indication)	C (Control)	Displayed as ON or OFF.
C (Control)	I (Indication)	Settable to ON or OFF (normally ON when Transmitter On and OFF when Transmitter Off).

RS-449 (V.36)

DTE	DCE	
CS (Clear to send)	RS (Request to send)	Displayed as ON or OFF.
RS (Request to send)	CS (Clear to send)	Settable to ON or OFF (normally ON when Transmitter On and OFF when Transmitter Off).
DTR (Data terminal ready)	DSR (Data set ready)	Set to ON.

V.35

DTE	DCE	
CS (Clear to send)	RS (Request to send)	Displayed as ON or OFF.
RS (Request to send)	CS (Clear to send)	Settable to ON or OFF (normally ON when Transmitter On and OFF when Transmitter Off).
DTR (Data terminal ready)	DSR (Data set ready)	Set to ON.

RS-232

DTE	DCE	
CTS (Clear to send)	RTS (Request to send)	Displayed as ON or OFF.

DSR (Data set ready)	DTR (Data terminal ready)	Displayed as ON or OFF.
RLSD (Receive line signal detect)	LL (Local loop)	Displayed as ON or OFF.
	RL (Remote loop)	Displayed as ON or OFF.
TM (Test Mode)		Displayed as ON or OFF.
RTS (Request to send)	CTS (Clear to send)	Settable to ON or OFF
DTR (Data terminal ready)	DSR (Data set ready)	(normally ON when Transmitter On and OFF when Transmitter Off).
	RLSD (Receive line signal detect)	Settable to ON or OFF.
	TM (Test Mode)	Settable to ON or OFF.
LL (Local loop)		Set to ON for V.54 loop 3 selected. Set to OFF for V.54 loop 3
deselected.		
RL (Remote loop)		Set to ON for V.54 loop 2 selected. Set to OFF for V.54 loop 2
deselected.		

Mode

X.21 (X.24)	Synchronous.
RS-449 (V.36)	Synchronous. Asynchronous.
V.35	Synchronous.
RS-232	Synchronous. Asynchronous.

Implementation	DTE. DCE (Option).

Electrical

X.21	V.11 (Balanced). V.10 (Unbalanced) (Option).
RS-449 (V.36)	V.11 (Balanced). V.10 (Unbalanced) (Option).
V.35	V.35 (data and timing). V.28 (control lines).
RS-232	V.28.

Line Code

RS-232, V.35	NRZ.
X.21, RS-449	NRZ.
(V.10, V.11)	Biphase Mark. Biphase Space.

Input Impedance

X.21, RS-449 (V.36)

V.11 Terminated	120 Ω.
V.11 Unterminated	>3000 Ω.
V.10	>3000 Ω.
V.35	100 Ω.

Data Rate	
V.11	50 bit/s to 2.5 Mbit/s.
V.10	50 bit/s to 100 kbit/s.
V.35	50 bit/s to 2.5 Mbit/s.
RS-232	50 bit/s to 38.4 kbit/s Async. 50 bit/s to 80 kbit/s Sync.
Timing	
Synchronous	
Transmitter	External. From DCE. Internal.
Receiver	External. From TX. From DTE. From DCE.
Asynchronous	
Transmit Internal	50, 75, 100, 110, 134.5, 200, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 9600, 19200, 38400 bit/s.
Receive	Receive signal.
Polarity	The polarity of the transmitter incoming and outgoing clocks and the receiver incoming clock can be selected.
Async coding	
Data bits	5, 6, 7, 8.
Stop bits	1, 1.5, 2.
Parity	Odd, even, none.
Async character rate	
Transmitter	Selectable: low, medium, high.
Receiver	Up to 1000 characters/sec.

Codirectional, Contradirectional and Eurocom D/1 (Option 22)
(2850B, 2850BS, 2851 and 2851S)

	Codirectional	**Contradirectional**	**EUROCOM D/1**
Line signal coding and level	To ITU-T Rec.G.703	To Rec.ITU-T G.703	TO EUROCOM D/1, IB6
Bit Rate	64 kbit/s	64 kbit/s	32, 64, 128, 256, 512, 1024, 2048 kbit/s
Format	Unstructured	Unstructured	Unstructured
Transmit Timing	Internal Receiver External 2048 kbit/s	Internal Receiver External 2048 kbit/s Contradirectional Input	Internal Receiver External (EUROCOM)
Transmit Timing Output	TTL at 64 kHz	TTL at 64 kHz	TTL at bit rate
Receive Timing	Receiver	Contradirectional input Receiver	EUROCOM Input Receive Signal
Connector	15 way D-Type, ISO4903	15 way D-Type, ISO4903	15 way D-Type, ISO 4903

Pinouts	**Codirectional**	**Contradirectional**	**EUROCOM D/1**
1, 9	Transmit Data Out (test interface) Transmit Data Out (receiver time slot access)	Transmit Data Out (test interface) Transmit Data Out (receiver time slot access)	Transmit Data Out
3, 11	Receive Data In (test interface) Receive Data In (transmitter time slot access)	Receive Data In (test interface) Receive Data In (transmitter time slot access)	Receive Data In
5, 13		Transmit Clock In (test interface)	Transmit Clock In (external)
7, 15		Receive Clock In (test interface)	Receive Clock In
4, 12		Transmit Clock Out (receiver time slot access and test interface)	Transmit Clock Out
2, 6, 8, 14	Ground	Ground	Ground

Receiver Clock Recovery — The receiver clock can be recovered from the data.

Test patterns	
Sync and async.	
PRBS	$2^9 - 1$. $2^{11} - 1$. $2^{15} - 1$. $2^{20} - 1$.
Sense	True or inverted.
All Ones	Continuous sequence of 1111.
All Zeros	Continuous sequence of 1111.
Alternating	Alternating sequence of 1010.
Sync	
16 bit word	User programmable sequence of 16 bits.
8 + 8 word	Two user programmable 8 bit sequences are alternated by an external TTL input. The changeover occurs at the end of 8 bits.
Async	
Fox Message	3 messages to CCITT Recommendation R.52.
Fox 1	International alphabet 2.
Fox 2	International alphabet 5, 96 character set.
Fox 3	International alphabet 5, 64 character set.
User message	1 - 19 characters
Error injection	
Singly	By keypress.
Fixed rate	Rate 3 x 10^{-1} to 1 x 10^{-7} (sync only).
Alarms	Line. Errors. Pattern.
Sync outputs	PRBS transmit and receive.
Polarity	Negative pulse.
Interface	TTL.
Errors output	An output pulse is provided for each pattern error (pin 16 of auxiliary connector).
Interface	TTL.
Pulse width	50% of bit interval.

STRUCTURED DATA (option 24)

X.50

Framing	Division 2, 80 channel Division 3, 20 channel
Status bit mode	
Unframed	The S bit can be set to 1 or 0, and monitored.
Framed (France)	The S bit is F + 7D where F is the status bit framing and is alternating 1 and 0, and D are data bits. The D bits can be set to 1 or 0, and monitored.
Distant alarm bit (A)	The A bit can be controlled and monitored.
Housekeeping bits (B to H)	The B to H bits can be controlled and monitored.
X.50 channel rate	
Division 2, 80 channel	600, 1200, 2400, 4800, 9600 kbit/s.
Division 3, 20 channel	2400, 4800, 9600 kbit/s.
Additional rates	14.4, 19.2, 48 kbit/s and user programmable.
X.50 bit rate	64 kbit/s.

6 + 2 and reiterated data

Framing	8 bit envelope with first bit framing, last bit status and 6 data bits.
Framing bit	The framing bit alternates 1, 0.
Status bit	Set 1 or 0 on transmitter and displayed on receiver.
Channel rate	600, 1200, 2400, 4800, 9600, 19200, 48000 bit/s.
Bit rate	
Reiterated	64 kbit/s
6 + 2 (non reiterated)	800, 1600, 3200, 6400, 12800, 25600, 6400, User.
Reiteration	7 bit and 8 bit.
Remote loop activation	
UK	Fixed word
Italy	Unstructured - programmable 8 bit-word

	Structured - programmable 6 bit-word DER Multipoint - programmable tributary sequence number
Interface	Codirectional. Contradirectional. V.11. TTL. 2048 kbit/s channel.
Codirectional	
Line signal coding and level	To ITU-T Recommendation G.703.
Transmit timing	Internal Recovered 64 kbit/s clock External 2048 kbit/s clock.
Receive timing	Recovered 64 kbit/s clock.
Contradirectional	
Line signal coding and level	To ITU-T Recommendation G.703
Transmit timing	Contradirectional Internal Recovered 64 kbit/s clock External 2048 kbit/s clock.
Receive timing	Contradirectional.
Connector (Co/Contra)	15 way D-type, ISO4903.

Pin	Function
1, 9	Transmit Data Out
2,10	Transmit D&I Data In
3,11	Receive Data In
4,12	Transmit Clock Out
5,13	Transmit Clock In
6,14	Receive Clock Out
7,15	Receive Clock In
8	Earth

Receiver termination	Terminated. Bridging.
V.11	
Transmit timing	V.11 Input. Internal. Recovered 64 kbit/s clock. External 2048 kbit/s clock.
Receive timing	V.11 Input. Recovered 64 kbit/s clock.
Connector	15 way D-type, ISO4903.

Pin	Function
1, 9	Transmit Data Out
2,10	Transmit D&I Data In
3,11	Receive Data In
4,12	Transmit Clock Out
5,13	Transmit Clock In
6,14	Receive Clock Out
7,15	Receive Clock In
8	Earth

Receiver termination	Terminated. Bridging.
Via 2048 kbit/s channel	64 kbit/s X.50 encoded signals can be inserted into a transmit 2048 kbit/s signal, and extracted from a receive 2048 kbit/s signal.
Transmit and Receive timing	2048 kbit/s channel.
TTL (Not available on 2851 or 2850B)	
Transmit timing	TTL Input. Internal. Recovered 64 kbit/s clock. External 1024 kbit/s clock.
Receive timing	TTL Input. Recovered 64 kbit/s clock.
Line code	NRZ. Biphase (M).

	Biphase (S)
Connector	15 way D-type, ISO4903.

Pin	Function
1	Transmit Data Out
2	Transmit D&I Data In
3	Receive Data In
4	Transmit Clock Out
5	Transmit Clock In
6	Receive Clock Out
7	Receive Clock In
8,9,11,13	Earth

Mode	
Transmit and receive are independent	
Transmit	Test pattern inserted within selected sub-channel.
Receive	Test pattern extracted from selected sub-channel and monitored for errors.
Drop & Insert	64 kbit/s or 2048 kbit/s signal looped through and a test pattern inserted in a selected sub-channel of an X.50 signal.
For Receive and Drop and Insert	The same or different sub-channel can be monitored for pattern errors on the receiver.
Test patterns	
PRBS	2^9-1, 2^{11}-1, 2^{15}-1, 2^{20}-1 2^{23}-1.
Programmable word	12 bit word pattern.
Fill pattern	2^7-1 PRBS. Programmable 6 bit word.
Error injection	
Singly	By keypress.
Fixed rate	1 x 10^{-2} to 1 x 10^{-8}.
Target	Framing bits. Pattern bits.
AIS Injection	AIS can be injected into transmit data in programmable bursts.
Burst range	0.01 to 99.9s.
Burst resolution	0.01s.
Loopbacks	
UK	Fixed word.
Italy	
Unstructured	Programmable 8 bit word.
Structured	Programmable 6 bit word.
DER multipoint	Programmable tributary sequence number.
Alarms	
Transmitter	TX no clock. D&I no clock. D&I no sync.
Receiver	Line. Frame. Framed status unsync. Errors. Distant. Pattern
Measurements	
Errors	Pattern. Framing
Errors processing	Totals. Ratios. Current error ratio. Residual error ratio. G.821 and histograms.
Frequency	Received 64 kbit/s rate

MEASUREMENTS

Error types	
PCM Interfaces	Line Code Errors (Bipolar violations). Pattern Errors. Framing Errors. CRC Errors.

Data Interfaces	Pattern Errors.
Main parameters	Number of errors.
Depends on PCM or Data Interface, Framing System and Test Mode.	Long Term Mean Error Ratio (LTMER). Total Test Time. Number of Loss of Signal (LOS) seconds. Number of AIS seconds. Number of No Frame Alignment seconds. Number of No Pattern Sync seconds. Number of No CRC Sync seconds.
Octet Slips	
Octet slips are detected for 64 kbit/s pattern measurements.	- Number of positive and negative slips. - Time since last slip. - Time between last two slips.
Further measurements.	One of the four error types is selected to be the basis for further measurements. The selection also controls the type of measurement presented as an error distribution with time and the source of errors routed to the rear panel ERRORS socket.
Additional parameters	
Current Error Ratio	
Automatic	Error ratio measured using short term algorithm.
Fixed Gating	1, 2, 5 or 10 seconds.
Burst Measurements	Number of bursts. Time between last two bursts. Time since last burst.
Residual Bit Error Rate (Background Error Rate)	Long Term Mean Error Ratio excluding Severely Errored Seconds.
G.821 error performance	
Measurements	64 kbit/s channel availability measurements are made to CCITT Recommendation G.821, while for higher rates a channel performance to G.821 Annex D is applied.
Parameters	- % Available Time - Number of Errored Seconds. - % Error Free Seconds. - Number of Severely Errored Seconds (SES). - % Non SES. - Number of Degraded Minutes (DM). - % Non DM. - Number of Breaks.

The inverse % parameters are also available. User programmable thresholds for %ES (%Errored Seconds), %SES (%Severely Errored Seconds), %DM (%Degraded Minutes) and %US (%Unavailable Seconds). Exceeding the threshold during a test causes message. Threshold activation settable for each patameter YES/NO.

Parameter	**Limit**	**Message**
%ES	XX.XXXX	%ES > limit
%SES	XX.XXXX	%SES > limit
%DM	XX.XXXX	%DM > limit
%US	XX.XXXX	%US > limit

X = 1 - 9

G.826

Parameters: Number of Errored Blocks (EB).
Number of Errored Seconds (ES).
Number of Severely Errored Seconds (SES).
Number of Background Block Errors (BBE).
Errored Seconds Ratio (ESR).
Severely Errored Seconds Ratio (SESR).
Backgound Block Error Ratio (BBER).
Unavailable Seconds (US).
% Unavailable Seconds (%US).
% Available Seconds (%AS).
Number of Breaks.

User programmable thresholds for ESR (Errored Seconds Ratio), SESR (Severely Errored Seconds Ratio), BBER (Background Block Error Ratio) and %US (% Unavailable Seconds). Exceeding the threshold during a test causes message. Threshold activation settable for each patameter YES/NO.

Parameter	Limit	Message
ESR	X.XE-Y	ESR > limit
SESR	X.XE-Y	SESR > limit
BBER	X.XE-Y	BBER > limit
%US	X.XXXX	%US > limit

X = 1 - 9, Y = 2 - 8

M.2100 Implementation of Interpretation for the Receive and Send Direction columns in Table B2/M.2100 for 2 Mbit/s signal (non CRC4) and 2 Mbit/s (CRC4).
User programmable thresholds S1 and S2 for ES (Errored Seconds), SES (Severely Errored Seconds) and US (Unavailable Seconds). Exceeding the threshold during a test causes message. Threshold activation settable for each patameter YES/NO

Parameter	S1 Limit	S2 Limit	Message
ES	XXXX	XXXX	ES > S1 limit or ES > S2 limit
SES	XXXX	XXXX	SES > S1 limit or SES > S2 limit
US	XXXX	XXXX	US > S1 limit or US > S2 limit

X = 1 - 9

G.826/M.2100 SES thresholds Performance thresholds can be set for Frame Errors, CRC Blocks and REI (E-bits).

G.821/G.921 histograms

Parameters
- Errored Seconds (ES).
- Severely Errored Seconds (SES).
- Degraded Minutes (DM).
- Breaks.

Test Length

Up to: 100 days.
100 hours.
50 hours.
25 hours.

Resolution

100 days 1 day.

100 hours 60 minutes.

50 hours 30 minutes.

25 hours 15 minutes.

Parameter Limits Limits calculated from user entered data and applied to selected resolution of 1 day or 60, 30 or 15 minutes. Histogram bar highlighted when limit exceeded.

G.821 limits User enters:
- length in km for High Grade section of line.
- length in km for Medium Grade section of line
- length in km for Low Grade section of line.
The line can be a combination of grades.
The limits for each are calculated and added.
For a Local or Medium grade block allocation user enters 1250 km.

G.821 limits (Radio) As for G.821 except limits are degraded for adverse propagation conditions.

G.921 limits

User enters: - length in km for Classification 1 section of line.

	- length in km for Classification 2 section of line. - length in km for Classification 3 section of line. - length in km for Classification 4 section of line.
	The line can be a combination of all Classifications. The block allocations are calculated for each and the overall limits totalised.
G.921 limits (Radio)	As for G.921 except limits are degraded for adverse propagation conditions.
User defined limits	User enters the day or 15, 30 or 60 minute limit directly for each parameter. The period limits are then calculated. For each category of error (i.e. DM, ES or SES), the user can specify the objective as a percentage of the nominal, and the allocation for the particular circuit under test.
Display	Histogram page for each of four parameters.
Printing results	PRINT DISPLAY prints histogram plus text equivalent of results and setup. SHIFT PRINT DISPLAY prints results for all four parameters for complete test.
Stored results	
Error Distribution and Histograms	The errors associated with the selected error type are stored, minute by minute, for later analysis.
Accumulation Time	72 hours.
Histogram	
Page width	- 20 hours with a resolution of 1 hour. - 20 minutes with a resolution of 1 minute. The display is selectable from anywhere within the 72 hours.
Display	The stored results are displayed as a histogram of errors. A cursor is moved to point at any hour or any minute. The number of errors, the number of errored seconds (ES) and the number of severely errored seconds (SES) for that interval are then displayed, together with the date and time. Intervals of loss of synchronisation and power loss are displayed on the baseline.
Test duration	When a test is started all results are cleared.
Duration	Indefinite. Timed.
Range	Programmable in the range 1 minute to 100 hours. Tests may be stopped at any time.
Propagation delay	Measured using a PRBS unframed test pattern to allow operation under high error rate conditions.
Range	Up to 2 seconds.
Resolution	1 bit period ± 2 microseconds.
Update rate	Typically 2 seconds. Can be longer at low data rates.
Channel associated signalling	Selected channel signalling analysis for systems incorporating channel associated signalling.
Display: Signalling code	
2048 kbit/s	- Decimal and binary equivalent of current and previous signalling code. - Signalling code for all 30 channels simultaneously.
T1	- Current and previous state of A and B bits. - Signalling code for all 24 channels simultaneously.
T1 ESF	- Current and previous state of A, B, C and D bits. - Signalling code for all 24 channels simultaneously.
Analysis	From a set of user entered values (signalling codes and mask limits), the last 20 dialled digits are displayed. An error indication is given if the mask limits are exceeded.
Errors	- Wrong signalling code. - Dial break pulse too wide. - Dial break pulse too narrow. - Inter Dial break pulse too wide or inter digit pause too narrow. - Inter Dial break pulse too narrow. - 11 or more dial break pulses.
C-bit framing	Monitoring of C-Bit Frame for French TRANSMIC-2G system. Display of C-Bit Frame message bits.
DTMF signalling	
(Dual tone multifrequency)	DTMF tones are generated and detected within 64 kbit/s channels on 2048 kbit/s and 1544 kbit/s (T1) systems.
Tone pairs (one from each group)	Low group - 697, 770, 852, 941 Hz. High group - 1209, 1336, 1477, 1633 Hz.

Generator	Generation of tone digits by keyboard entry.
Modes	Tone burst to preset length. Sequence preset up to 19 digits. Tone generated sent to loudspeaker if switched on.
Receiver	Receipt and display of valid tone digits. No detection of short tones or other errors is provided.
Bit rate measurement	The bit rate is measured every second displayed to nearest 1 Hz.
Accuracy	±10 ppm.
Digital signal level measurement	The amplitude of the incoming signal is measured and displayed in Volts peak and dB relative to nominal
Range	+3 to -35 dB.
Accuracy	
+3 to −10 dB	±1.5 dB.
−10 to −20 dB	±2 dB.
−20 to −30 dB	±3 dB.
Audio level measurement	Measurement of signal level in a single 64 kbit/s channel.
2 channel synchronisation measurement	The clocks are extracted from two primary rate digital signals and compared for synchronisation. One of the inputs is used as a reference. A sync slip is registered for each bit of relative phase shift.
Measurement	- Number of slips in current second. - Total slips since start of test.
Timing Measurement (DTE only)	Time intervals between changes of control lines.
X.21	C and I.
RS-449 (V.36)	RS and CS.
V.35	RTS and CTS.
RS-232	RTS and CTS.
Range	0 to 10 s
Resolution	1 ms.
Parameter rules	
Loss of signal (LOS)	Errors in loss of signal (LOS) second are discarded.
Framing Errors	Errors in loss of frame (LOF) second are discarded
Pattern Errors	Pattern errors are counted up to the point when pattern synchronisation is lost. The count is suspended until synchronisation is regained.
CRC Errors	Errors in any second with loss of CRC multiframe sync are discarded.
Allowed seconds	Seconds in which errors are not discarded.
Error counts	Count displays reach 999,999,999 and then stop.
Error ratios	Displayed in the form $X \times 10^{-Y}$ where X is 1 to 9 and Y is 2 to 11.
Percentages	Displayed to 6 decimal places and displayed rounded to 5.
Update rate	Results are updated every second
Unavailable time	A period of unavailable time begins when the error ration in each second is worse than 1×10^{-3} (or otherwise severely errored) for ten consecutive seconds. These ten seconds are considered part of the unavailable time. The period of unavailable time terminates when the error ratio in each errored second is better than 1×10^{-3} for ten consecutive seconds. These ten seconds are considered part of the available time.
Break	A period of unavailable time.
Errored Second	A second of available time in which one or more errors are detected.
Error Free Second	A second of available time in which no errors are detected.
Severely Errored Second	A second of available time in which the error ratio is worse than 1×10^{-3}.

	A second of available time in which the CRC block error rate is greater than: 830 errored CRC blocks in 1 second for 2048 kbit/s systems (M.550, M.2100). 320 errored CRC blocks in 1 second for 1544 kbit/s systems (M.550, M.2100). Note that a one second interval containing loss of signal or loss of synchronisation is considered to be a severely errored second.
Non Severely Errored Second	A second of available time in which the error ration is equal to or better than 1×10^{-3}.
Degraded Minute	A one minute interval during which the error ratio is worse than 1×10^{-6}. The one minute intervals are obtained by ignoring unavailable time and severely errored seconds and consecutively grouping the remaining seconds.
Non Degraded Minute	A one minute interval (as defined above) during which the error ratio is equal to or better than 1×10^{-6}.

Measurements

Total Test Time	A count incremented once every second that the test is in progress. Displayed as days, hours, mins, seconds.
Number of Errors	The total number of errors (to date or to end of test) in the allowed seconds.
Long Term Mean Error Ratio (LTMER)	The ratio of Number of Errors to the Total Number of relevant bits
Number of Loss of Signal (LOS) seconds	The total number of seconds in which there was no input signal.
Loss of Signal events	The number of blocks of consecutive Loss of Signal seconds.
Number of AIS seconds	The total number of seconds in which an AIS is detected.
AIS events	The number of blocks of consecutive AIS seconds. LOS seconds are not included.
Number of Loss of Frame Alignment (LOF) seconds	The total number of seconds in which a Frame Alarm is detected.
Loss of Frame events	The number of blocks of consecutive Loss of Frame seconds. LOS and AIS seconds are not included.
Number of Loss of Pattern Sync (LOP) seconds	The total number of seconds during which there was no Pattern Sync.
Loss of Pattern Sync events	The number of blocks of consecutive Loss of Pattern Sync seconds. LOS, AIS and LOF seconds are not included.
Number of Loss of CRC Sync (LOC) seconds	The total number of seconds during which Loss of CRC Alignment (LOC) was detected.
Loss of CRC Sync events	The number of blocks of consecutive Loss of CRC Sync seconds. LOS, AIS and LOF seconds are not included.
Short Term (Current) Error Ratio	The Auto algorithm used results in a fast attack/slow decay response which responds quickly to a rise in error ratio but falls slowly when the error ratio decreases. Also 1, 2, 5 and 10 seconds gating.
Number of Bursts	The total number of bursts in the allowed seconds. A burst is defined as the detection of more than X errors in a multiframe where X may be set between 8 and 256.
Time between last two Bursts	The time between the last two bursts is displayed in hours, mins, secs, millisecs.
Time since last Burst	The time since the last burst is displayed in hours, mins, secs, millisecs.
% Available Time	The ratio of available time to total test time.
% Unavailable time	The ratio of unavailable time to total test time.
Number of Errored Seconds (ES)	The total number of available seconds in which one or more errors were detected.
% Errored Seconds	The ratio of errored seconds to available time.
% Error Free Seconds	The ratio of error free seconds to available time.
Number of Severely Errored Seconds (SES)	Total number of SES.
% Severely Errored Seconds	The ratio of SES to available time.
% Non Severely Errored Seconds	The ratio of non SES to available time.
Number of Degraded Minutes (DM)	Total number of DM.

% Degraded Minutes	The ratio of DM to available time.
% Non Degraded Minutes	The ratio of non DM to available time.
Number of Breaks	Total number of Breaks.
Errored Seconds Ratio (ESR)	Ratio of ES in available time to available seconds.
Severely Errored Seconds Ratio (SESR)	Ratio of SES in available time to available seconds.
Number of Background Block Errors (BBE)	Total number of BBE.
Background Block Error Ratio (BBER)	Ration of BBE in available time to total blocks in available time (BBE are not counted in SES seconds).
Number of Unavailable Seconds (US)	Total number of unavailable seconds.
% Unavailabale Seconds	Ratio of US to available time.

GENERAL CHARACTERISTICS

Operator interface	The instrument is controlled via a keyboard containing a data entry keypad, dedicated keys and five soft-keys used in conjunction with a Cold Cathode Backlit Liquid Crystal Display. The 8 line by 40 character (plus graphics capability) LCD and keyboard are fully interactive providing menu and soft-key operation.
Displays	Transmit parameters. Receive parameters. Measurement Results including Stored Results. RS-232C Port parameters. Printer Type selection. Measurement definition. Autoprint definition. Setup Conditions (Stored Parameters). Current Status.
Audible alarm	
Mode	ON. OFF.
ON	Alarm sounds on detection of: - Loss of any sync/signal. - Any errored second.
Loudspeaker	Selected 64 kbit/s channels can be routed to the loudspeaker. There is a volume control.
Setup conditions (storage facility)	A variety of information can be stored in non-volatile memory (battery backed-up).
Last Operation	The instrument retains all setup parameters when powered down. These are reinstated when the instrument is powered up.
Configuration Stores	18 sets of transmitter/receiver/test definition parameters can be selected for storage. Each set can be recalled whenever required, and can be identified with a 12 character label.
Fixed configuration stores	18 sets of typical common instrument configuration settings are stored and can be recalled.
Real time clock	Displays date and time.
Resolution	One second.
Accuracy	$\pm$1 minute per week.
Power fail/test continue	If mains power is lost during a test, the test is resumed when power returns.
Indications	Power Fail page. Autoprint output.
Multiple tests storage	6 full sets of test results can be stored for later analysis and/or printing.
Print to RAM	Up to 8,000 print lines can be stored in memory for subsequent scrolling on screen with full or partial print capability. Where required Print to RAM results can be stored with associated test results.
Keyboard lockout	The keyboard can be disabled whilst a test is running.
Printer facilities	
Page print or Autoprint printers	40 column minimum.
Page Printing	Page printouts are initiated by the PRINT key and cause the whole of the current page to be printed. Graphics display pages can be printed in a text equivalent or a facsimile to a suitable printer.
Autoprinting	The printer can be set automatically to print on the occurrence of any of the following (where applicable), each event printed with its date and time and two digit identity number. A twelve character label is also printed where appropriate: -Test start and stop. - Loss and restoration of signal. - Loss and restoration of alignment. - Loss and restoration of patter sync. - Detection of errors (ES). - Detection of burst errors. - Detection of ISDN error report alarm pulse (2048 kbit/s ISDN system). - Detection of change of state of bit 5 in Not Frame Word (2048 kbit/s ISDN system). - Detection of alarms. - Detection of octet slips. - Detection of a short term (current) error ratio, for the selected major error type, - crossing a user set threshold. - Detection of change of signalling code.
Autoprinting *(contd.)*	- Cumulative printout at preselectable intervals of 15 mins, 30 mins, 1 hour, 6 hours, 12

	hours or 24 hours. - Stored results, G.821 results, and two channel synchronisation slips may be included in interval print. - Loss and restoration of power.
Printer Operation	- Page printing. - Long term collection of information via the Autoprint facility.
Remote control	Remote commands are made up from a mixture of text and data. Commands are grouped into logical sets and allow for ease of use and self-documenting control programs. Most controls are remotely programmable.
RS-232 port	The RS-232 port is used for printer operations, remote control, or for duplication of the display onto a terminal.
Type	Asynchronous. DTE. Full Duplex.
Bit Rates	300, 600, 1200, 2400, 4800 and 9600 bit/s.
Code	ASCII.
Code bits/Parity/Stop bits	7/Odd/1, 7/Even/1, 7/Odd/2, 7/Even/2, 8/None/1, 8/None/2.
Handshake Hardware	DTR, RTS, CTS and DSR.
Software	XON and XOFF.
Lines Used	
Tx DATA	Pin 2.
RTS	Pin 4.
DTR	Pin 20.
Rx DATA	Pin 3.
CTS	Pin 5.
DSR	Pin 6.
Connector	25 way female D-type.
Electrical	To RS232C/V.28.
IEEE 488 (option) (2850BS and 2851S only)	Used for remote control or printer operations.
Limit range of operation	
Temperature	0 to 55°C.
Safety	
2850B(S) & 2851(S)	Conforms with the requirements of EEC Council Directive 73/23/EEC and Standards IEC/EN 61010-1 : 2001 + C1 : 2002 + C2 : 2003 for Class I portable equipment and is for use in a pollution degree 2 environment. The equipment is designed to operate from installation supply category I or II.
Conditions of storage and transport	
Temperature	−40 to +70°C.
Humidity	Up to 90% relative humidity (non condensing).
Altitude	Up to 2500 m (pressurized freight at 27 kPa differential).
Electro-magnetic compatibility	
2850BS & 2851S	Conforms with the protection requirements of the EEC Council Directive 89/336/EEC. Conforms with the limits specified in the following standards: IEC/EN61326-1 : 1997, RF Emission Class B, Immunity Table 1, Performance Criterion B

Power requirements	
A.C. Operation	
A.C. Voltage	105 - 120 V ~ (Limit 90 - 132 V~) 210 - 240 V ~ (Limit 188 - 265 V~)
Frequency	50 - 60 Hz (Limit 45 - 66 Hz)
Consumption	20 VA maximum.
D.C. Operation (Option)	One of three options can be specified.
48 V	
Range	±36 to ±60 V, 0.8 A max.
24 V	
Range	±20 to ±36 V, 1.5 A max.
12 V	
Range	±10 to ±18 V, 2.5 A max.
Battery Operation (Option)	
Operating time	7 hours or 3 hours (Option 24) with backlight timeout of 5 minutes for temperature range of 17 to 27°C.
Charge time	15 hours.
Temperature range for full nominal charge	10 to 30°C.
Temperature range for full nominal discharge	0 to 50°C.
Limit range of operation	
Charge	0 to 35°C.
Discharge	0 to 50°C.
2850B and 2851	Mounts under 2850B and 2851.
2850BS and 2851S	Mounts inside 2850BS and 2851S.
Weight	2.7 kg.

Dimensions and weight

	Height	Width	Depth	Weight
2850B and 2851	110 mm max	353 mm	297 mm	4 kg
2850BS and 2851S	197 mm	345 mm	477 mm	7.5 kg

Auxiliary connector

25 Way D-Type

Pin	Function
1-2	Earth.
3	Transmit External TTL Clock Input
4	Alarm Extension Output.
5	Transmit PRBS Sync Output.
6	Receive PRBS Sync Output.
7	+5 V.
8	Pattern Alternate Input.
9-13	Earth.
14	Receive NRZ Line Data Input.
15	Receive NRZ Line Clock Input.
16	Errors Output.
17	SPARE.
18	Transmit TTL Data Output
19	Transmit NRZ 64 kbit/s Data Input/Receive TTL Data Input
20	Receive NRZ 64 kbit/s Clock Output.
21	Receive NRZ 64 kbit/s Data Output.
22	Transmit NRZ Line Data Output.
23	Transmit NRZ Line Clock Output/Transmit TTL Clock Output
24	Receive Demultiplex Clock Output.
25	Receive Demultiplex Data Output.

OPTIONS AND ACCESSORIES

Versions	Description
2850B	Digital Transmission Analyzer, Desktop Version.
2850BS	Digital Transmission Analyzer, Metal Case Version.
2851	Digital Communications Analyzer, Desktop Version.
2851S	Digital Communications Analyzer, Metal Case Version.

Note that 2850B and 2850BS do not provide RS-232, X.21, RS-449 and V.35 test interfaces.

Option	Allowed Combinations					Description
01	★	★	★	★	★	European - 2048 & 8448 kbit/s.
02			★			European - Add 1544 kbit/s (T1).
03				★		European - Add 704 kbit/s.
04					★	European - Add 704 kbit/s, T1, T1C, T2 (No ALBO).
25		★				European - Eurocom D/1 IB5, and Eurocom D/1 IB6, 704, 2048, 8448 kbit/s (no ALBO)
08	†	†	†	†	†	French key panel
09	†	†	†	†	†	1.6/5.6 Connectors.
10	†	†	†	†	†	DC Input - ±20 V to ±60 V (includes cable).
11	†	†	†	†	†	DC Input - ±10 V to ±18 V (includes cable).
12	†	†	†	†	†	Battery.
13	†	†	†	†	†	IEEE-488 (2850BS and 2851S).
15	†	†	†	†	†	DC input - ±36 V to ±60 V (includes cable).
16	†	†	†	†	†	DC input ±20 V to ±36 V (includes cable).
17	†	†	†	†	†	DC input ±10 V to ±18 V (includes cable).
22	†	†	†	†	†	EUROCOM D/1 IB6
23	†	†	†	†	†	Data Interface Switch
24	†	†	†	†	†	Structured Data (X.50 + reiterated data)
26	†	†	†	†	†	V.11 data rate to 9 Mbit/s

★ Basic options
† Additional options
Options 10 and 11 are mutually exclusive..
Option 15, 16 and 17 are mutually exclusive.
Option 13 is available only on 2850BS and 2851S.
Options 10, 11 and 24 are mutually exclusive on 2850B and 2851.
For Option 24 the TTL interface is not available on 2850B and 2851.
Option 26 is available only on 2851 and 2851S
For DC input when specifying Option 24 on 2850BS and 2851S, use Option 15, 16 or 17 not Options 10 or 11.

Part Number	Supplied Accessories
43123/076	Supply lead.
41690/485	Stowage Cover (2851S only).
46884/604	Audio Jack Plug (Qty 2).
46884/403	15 way D-Type Connector.
54311/125	X.21 Adapter Lead - V.11, DTE.
54311/127	RS-449 Adapter Lead - V.11, DTE.
54311/131	V.35 Adapter lead - DTE.
46882/128	Operating Manual.
46882/127	Introductory Guide.

Part Number	Use	Optional Accessories
46880/004	Common	Service Manual
54311/126	Common	X.21 Adapter Lead - V.10, DTE, female.
54311/140	Common	X.21 Adapter Lead - V.11, DCE, female.
54311/141	Common	X.21 Adapter Lead - V.10, DCE, female.
54311/128	Common	RS-449 Adapter Lead - V.10, DTE, female.
54311/142	Common	RS/449 Adapter Lead - V.11, DCE, female.
54311/143	Common	RS-449 Adapter Lead - V.10, DCE, female.
54311/144	Common	V.35 Adapter Lead - DCE, female.
54311/152	Common	RS-232 Adapter Lead - DCE, female.
54311/121	Common	RS-232 Lead - male to male - 25 way D-Type - 1.5 m.
54311/122	Common	X.21 Lead - male to male - 15 way D-Type - 1.5 m.
54311/147	Common	RS-449 Lead - male to male - 37 way D-Type - 1.5 m.
54311/148	Common	V.35 Lead - male to male - 34 way MRAC - 1.5 m.

continued/...

Part Number	Use	Optional Accessories *(contd.)*
54311/130	Common	Co/Contradirectional Test Lead - 15 way D-Type to free end.
43129/189	Common	IEEE-488 Lead (2851S).
46662/387	Common	RS-232 Null Modem (female to female).
46883/805	European	Signal Lead balanced (CF-CF).

43139/042	European	Signal Lead (BNC-BNC), 1.5 m.
46662/388	European	BNC to 1.6/5.6 adapter.
46884/402	Common	D-Type connector 25 way.
46662/490	Common	Hard Carrying Case (2850B and 2851).
46662/493	Common	Soft Carrying Case (2850B and 2851).
46662/192	Common	Transit Case (2850BS and 2851S).
46662/499	Common	Soft Carrying Case (2850BS and 2851S).
44991/035	Common	Remote Applications Software: single user licence version.
44991/039	Common	Remote Applications Software: site licence version.
54416/001	European	Drop and Insert Testguard (75 Ω unbalanced).
46883/852	Common	Null Modem (female to female).
46883/824	Common	Gender changer (female to female).
54127/309	Common	Rack Mount Kit (2850BS and 2851S only).
54717/039	Common	Scriptos printer
54311/216	Common	RS-232 special printer lead
46662/260	Common	Scriptos paper, 10 packs

2852 & 2852S / 2853 & 2853S

PCM TRANSMIT INTERFACE

Framing and bit rates	As 2850B, 2851 PLUS:
34368 kbit/s	
Unframed.	G.751 asynchronous (option).
Permitted combinations of bit rates	2048 & 8448 & 34368 kbit/s or 704 & 2048 & 8448 & 34368 kbit/s or 1544 & 2048 & 8448 & 34668 kbit/s or 704 & 2048 & 8448 & 1544 & 3152 & 6312 & 34368 kbit/s.
AIS	
Unframed	All ones signal with zeros programmable at a rate of M × $10^{-N,}$ where M is 1-9 and N IS 2-7.
Framed	
34368 kbit/s	All ones signal transmitted in a selected 8448 kbit/s tributary.
8448 kbit/s	All ones signal transmitted in a selected 2048 kbit/s tributary.
Clock source	
34 Mbit/s	Internal or external
Internal	
Accuracy	±10 ppm from 0°C to 55°C. ±3 ppm/year.
Small Offset	Steps of 5 and 25 ppm to maximum of ±60 ppm.
External	
34 Mbit/s	Pin 13 of 15 way D-Type connector (34 Mbit/s NRZ).
Framed	34.368 MHz ±60 ppm.
Unframed	8 to 35 MHz.
Level	TTL.
Impedance	50 Ω.
Clock output	TTL via 50 Ω.
Line codes	AMI (50% duty cycle). HDB3. NRZ (TTL level).
Main outputs	
Unbalanced	
Impedance	75 Ω.
Peak Voltage	1.0 V ±0.1 V.
Space Voltage	0 V ±0.1 V.
NRZ digital output	
34 Mbit/s.	Unframed only.
Frequency Range	0.5 to 35 Mbit/s.
Level	TTL.
Connector	15 way D-Type (see end of specification for pinout).
Test patterns	
Insertion	
Single Channel	Selected 64 kbit/s channel of framed signal. Selected 64 kbit/s channel of 2048 kbit/s tributary. (8 and 34 Mbit/s output - option 14 fitted).
n × 64kbit/s Channel	Selected n × 64 kbit/s channel of framed signal. Selected n × 64 kbit/s channel of 2048 kbit/s tributary. (8 and 34 Mbit/s output - option 14 fitted). Channel distribution can be contiguous or non-contiguous.
2048 kbit/s Tributary	Selected 2048 kbit/s tributary. (8 and 34 Mbit/s output - option 14 fitted).
8448 kbit/s Tributary	Selected 8448 kbit/s tributary. (34 Mbit/s output only - option 14 fitted).
Unframed	Unframed signal.
PRBS	
34 Mbit/s	$2^{15}-1$. $2^{18}-1$.

	$2^{20}-1$. $2^{23}-1$. $2^{25}-1$. $2^{28}-1$.
All zeros	Continuous sequence of 0000.
All ones	Continuous sequence of 1111.
Alternating	Alternating sequence of 1010.
Word	User programmable sequence of 24 (34 Mbit/s only), 16 or 8 bits.
8 + 8 word	Two user programmable 8 bit sequences are alternated by an external TTL input. The changeover occurs at the end of 8 bits.
1 kHz 0 dBm0 sine wave	Digital representation of a sinusoidal signal of 1kHz at a nominal level of 0 dBm0, coded according to A-Law. This facility is not available for 1544 kbit/s systems.
Fill patterns	All other channels in single channel and n × 64 kbit/s framed operation PRBS. User programmable 8 bit word.
8 and/or 2 Mbit/s tributaries (option 14 fitted)	AIS (All 1s). PRBS. All 0s. Alternating 10. 2 or 8 Mbit/s test pattern.
Insert	For framed and multiplex operation, an externally input 64 kbit/s data stream or a voice frequency signal can be inserted into one of the channels in the transmitted signal instead of a test pattern.
Data Input	Applies to frame structures at 704, 1544, 2048 and 8448 kbit/s (G.704/G.744). Applies to 2048 kbit/s tributaries within frame structures at 8448 kbit/s (G.742) and 34 Mbit/s (G.751) (option 14 fitted).
Data Input Interface	Codirectional to G.703. Contradirectional to G.703 (AMI 100% or Bipolar NRZ). X.21. NRZ (TTL level).
Voice frequency input	Applies to frame structures at 1544 and 2048 kbit/s. Applies to 2048 kbit/s tributaries within frame structures at 8448 kbit/s (G.742) and 34 Mbit/s (G.751) (option 14 fitted).
Range	0.3 to 3.4 kHz.
Encoding	A-Law for 2048 kbit/s. μ-Law for 1544 kbit/s.
Impedance	600 Ωs balanced.
Max Input Level	+3 dBm0.
Error injection	
Target	At 34 Mbit/s, unframed test pattern only.
Error Type	
Binary	Bits are inverted before coding.
Code	Code errors are injected by changing ±1 to 0 and 0 to ±1 where the polarity of the inserted mark is the same as the polarity of the last mark transmitted.
Injection Mode	
Singly	By keypress.
Fixed rate	34 Mbit/s 3×10^{-2} to 1×10^{-8}.
Access to structure bits (34 Mbit/s)	Frame alignment strategy. Change unassigned, distant and alarm bits.
Sync outputs	PRBS
Polarity	Negative pulse.
Interface	TTL.

PCM RECEIVE INTERFACE

Framing and bit rates	As Transmitter.
Permitted combinations of bit rates	As Transmitter.
Frequency Tolerance	As 2850B, 2851 PLUS:
34368 kbit/s	±60 ppm.
Line codes	As Transmitter.
Digital input	
Connector	BNC.
Impedance	75 Ω unbalanced.
NRZ digital input	34 Mbit/s.
Unframed only	
Frequency Range	0.5 to 35 Mbit/s
Level	TTL.
Connector	15 way D-Type (see end of specification for pinout).
Input modes and sensitivity	34 Mbit/s
Terminated	Terminates the line.
Sensitivity	±1 V +3 −12 dB cable attenuation or −18 dB linear attenuation.
Bridging	Taps onto a terminated line or unprotected monitor point.
Sensitivity	±1 V +3−9 dB cable attenuation or −12 dB linear attenuation.
Monitor	Connects to a protected monitor point.
Sensitivity	−14, −26, −38 dB relative to nominal with range of +3 to −9 dB cable attenuation or −12 dB linear attenuation.
Test patterns	
Source	
Single Channel	Selected 64 kbit/s channel of framed signal. Selected 64 kbit/s channel of 2048 kbit/s tributary. (8 and 34 Mbit/s input - option 14 fitted).
n × 64 kbit/s Channel	Selected n × 64 kbit/s channel of framed signal. Selected n × 64 kbit/s channel of 2048 kbit/s tributary. (8 and 34 Mbit/s input - option 14 fitted). Channel distribution can be contiguous or non-contiguous.
2048 kbit/s Tributary	Selected 2048 kbit/s tributary. (8 and 34 Mbit/s input - option 14 fitted).
8448 kbit/s Tributary	Selected 8448 kbit/s tributary. (34 Mbit/s input only - option 14 fitted).
Unframed	Unframed signal.
PRBS	
34 Mbit/s	$2^{15}-1$. $2^{18}-1$. $2^{20}-1$. $2^{23}-1$. $2^{25}-1$. $2^{28}-1$.
Repetitive Word	Any word which repeats over a 24 bit (34 Mbit/s only) or 16 bit sequence.
Channel extract	For framed single channel and demultiplex operation a selected 64 kbit/s channel is extracted from the received signal and output as a data signal or voice frequency signal. The audio output is also available on the internal loudspeaker.
Data Output	Applies to frame structures at 704, 1544 and 8448 kbit/s (G.704/G.744). Applies to 2048 kbit/s tributaries within frame structures at 8448 kbit/s (G.742) and 34 Mbit/s (G751) (option 14 fitted).
Data Output Interface	Codirectional to G.703. Contradirectional to G.703 (100% AMI or Bipolar NRZ). X.21. NRZ (TTL level).
Frame or AIS alarm detected	All 1’s transmitted.
Signal loss detected	Outputs are off.
Clock Output	64 kHz NRZ (TTL).

Voice Frequency Output	Applies to frame structures at 1544 and 2048 kbit/s. Applies to 2048 kbit/s tributaries within frame structures at 8448 kbit/s (G.742) and 34 Mbit/s (G.751) (option 14 fitted).
Range	0.3 to 3.4 kHz.
Decoding	A-Law for 2048 kbit/s. μ-Law for 1544 kbit/s.
Impedance	600 Ω balanced.
Status indicators	A combination of LEDs and an alarm page indicate frame structure alarm conditions for the input signal and, for demultiplex operation, the tributaries selected. For demux mode hierarchical AIS, FRAME and DISTANT alarms are ORed to the LED.
Unassigned framing bits	The state of the unassigned bits is displayed.
Sync outputs	PRBS.
Polarity	Negative pulse.
Interface	TTL.

DATA TEST INTERFACES

X.21 (X.24), RS-449 (V.36), V.35 and RS-232	As 2851 (2853 only).
Codirectional, Contradirectional and Eurocom D/1 (Option 22)	As 2850B, 2851.
Test patterns	As 2851.
Error injection	As 2851.
Alarms	As 2851.
Sync outputs	As 2851.
Errors output	As 2851.

MEASUREMENTS

Error types	
PCM Interfaces	Line Code Errors. Pattern Errors. Framing Errors. CRC Errors.
Data Interfaces	Pattern Errors.
- Line Code Errors	Measured on input signal rate.
- Framing Errors	Measured at each hierarchical level for the demultiplex path selected.
- Pattern Errors	Measured for the selected test pattern which can be a tributary, 64 kbit/s, n × 64 kbit/s channel, or unframed.
- CRC Errors	Measured as appropriate for selected input signal, or 2048 kbit/s tributaries.
Main parameters	As 2851.
Additional parameters	As 2851.
G.821 error performance	As 2851.
G.821/G.921 histograms	As 2851.
Stored results	As 2851.
Test duration	As 2851.
Propagation delay	Measured using a PRBS unframed test pattern to allow operation under high error rate conditions.
34 Mbit/s	
Range	Up to 8 seconds.
Resolution	1 bit.
Update rate	Typically up to 8 seconds.
Signalling	As 2851.
Bit rate measurement	The bit rate is measured every second or every 2 seconds (34 Mbit/s) and displayed to the nearest 1 Hz.
Accuracy	±2 ppm ±1 count.
Digital signal level measurement	The amplitude of the incoming digital signal is measured and displayed in Volts peak and dB relative to nominal.
34 Mbit/s.	
Terminated and Bridging Range	+3 to −20 dB.
Accuracy	±1 dB.
Monitoring Range	
14 dB: 26 dB 38 dB:	−10 to −34 dB. −22 to −44 dB. −34 to −44 dB.
Accuracy	±2 dB.
2 channel synchronisation measurement	As 2851.
Timing Measurement (DTE only)	As 2851.

GENERAL CHARACTERISTICS
As 2851 except:

IEEE 488 (option)	2853S only.
Power requirements	
A.C. Operation	
A.C. Voltage	105 - 120 V ~ (Limit 90 - 132 V~). 210 - 240 V ~ (Limit 188 - 265 V~).
Frequency	50 - 60 Hz (Limit 45 - 66 Hz).
Consumption	45 VA maximum.
D.C. Operation (Option)	One of three options can be specified.
48 V	
Range	±36 to ±60 V, 0.9 A max.
24 V	
Range	±20 to ±36 V, 1.8 A max.
12 V	
Range	±10 to ±18 V, 3.3 A max.
Battery Operation (Option)	
Operating time	7 hours or 3 hours (34 Mbit/s) with backlight timeout of 5 minutes for temperature range of 17 to 27°C.
2852 and 2853	Mounts under 2852 and 2853.
2852S and 2853S	Mounts inside 2852S and 2853S.
Weight	2.7 kg.
Dimensions and weight	

2852 and 2853

Height	Width	Depth	Weight
110 mm max	353 mm	297 mm	4.5 kg

2852S and 2853S

Height	Width	Depth	Weight
197 mm	345 mm	477 mm	8 kg

34 Mbit/s NRZ connector

15 way D-Type

Pin Number	Description	Function
2-8	0 V	
13	Transmit Clock In	NRZ
11	Transmit Clock Out	NRZ
12	Transmit Data Out	NRZ
15	Receive Clock In	NRZ
14	Receive Data In	NRZ
10	Transmit Clock In	HDB3/AMI clock - 50 Ω
1,9	not connected	

OPTIONS AND ACCESSORIES

Versions	Description
2852	Digital Transmission Analyzer, Desktop Version.
2852S	Digital Transmission Analyzer, Metal Case Version.
2853	Digital Communications Analyzer, Desktop Version.
2853S	Digital Communications Analyzer, Metal Case Version.

Note that 2852 and 2852S do not provide RS-232, X.21, RS-449 and V.35 test interfaces.

Option	Allowed Combinations										Description
01	★	★	★	★	★	★	★	★	★	★	2, 8 Mbit/s framed & 34 Mbit/s unframed.
02				★				★			Add 1544 kbit/s (T1).
03					★				★		Add 704 kbit/s.
04						★				★	Add 704 kbit/s, T1, T1C, T2 (No ALBO).
25		★	★								Eurocom D/1 IB5 and Eurocom D/1 IB6, 704, 2048, 8448 kbit/s (no ALBO) and 34 Mbit/s unframed.
14		★					★	★	★	★	Add 34 Mbit/s framed & mux/demux.
08	†	†	†	†	†	†	†	†	†	†	French key panel..
09	†	†	†	†	†	†	†	†	†	†	1.6/5.6 Connectors.
15	†	†	†	†	†	†	†	†	†	†	DC Input – ±36 V to ±60 V (includes cable).
16	†	†	†	†	†	†	†	†	†	†	DC Input – ±20 V to ±36 V (includes cable).
17	†	†	†	†	†	†	†	†	†	†	DC Input – ±10 V to ±18 V (includes cable).
12	†	†	†	†	†	†	†	†	†	†	Battery.
13	†	†	†	†	†	†	†	†	†	†	IEEE-488 (2852S and 2853S).
22	†	†	†	†	†	†	†	†	†	†	Eurocom D/1 IB6.
26	†		†	†	†	†	†	†	†	†	V.11 data rate to 9 Mbit/s

★ Basic options
† Additional options
Options 15, 16 and 17 are mutually exclusive.
Option 13 is available only on 2852S and 2853S.
Option 26 is available only on 2853 and 2853S

Part Number	Supplied Accessories
43129/03	Supply lead.
41690/485	Stowage Cover (2852S and 2853S only).
46884/604	Audio Jack Plug (Qty 2).
46884/403	15 way D-Type Connector.
54311/125	X.21 Adapter Lead - V.11, DTE.
54311/127	RS-449 Adapter Lead - V.11, DTE.
54311/131	V.35 Adapter lead - DTE.
46882/128	Operating Manual.
46882/127	Introductory Guide.

Part Number	Optional Accessories
46880/004	Service Manual
54311/126	X.21 Adapter Lead - V.10, DTE, female.
54311/140	X.21 Adapter Lead - V.11, DCE, female.
54311/141	X.21 Adapter Lead - V.10, DCE, female.
54311/128	RS-449 Adapter Lead - V.10, DTE, female.
54311/142	RS-449 Adapter Lead - V.11, DCE, female.
54311/143	RS-449 Adapter Lead - V.10, DCE, female.
54311/144	V.35 Adapter Lead - DCE, female.
54311/152	RS-232 Adapter Lead - DCE, female.
54311/121	RS-232 Lead - male to male - 25 way D-Type - 1.5 m.
54311/122	X.21 Lead - male to male - 15 way D-Type - 1.5 m.
54311/147	RS-449 Lead - male to male - 37 way D-Type - 1.5 m.
54311/148	V.35 Lead - male to male - 34 way MRAC - 1.5 m.
54311/130	Co/Contradirectional Test Lead - 15 way D-Type to free end.
43129/189	IEEE-488 Lead (2852S and 2853S).
46662/387	RS-232 Null Modem (female to female).
46662/373	Printer P40S.
46662/374	P40S Charger (UK) 240 V.
46662/376	P40S Charger (German) 220 V.
46662/377	P40S Charger (US) 110 V.
46662/378	P40S RS-232 special lead.
46662/380	P40S paper 5 pack. *.continued /...*

Part Number	Optional Accessories *(contd.)*
46883/805	Signal Lead balanced (CF-CF).
43139/042	Signal Lead (BNC-BNC), 1.5 m.

46662388	BNC to 1.6/5.6 adapter.
46884/402	D-Type connector 25 way.
46662/490	Hard Carrying Case (2852 and 2853).
46662/493	Soft Carrying Case (2852 and 2853).
46662/192	Transit Case (2852S and 2853S).
46662/499	Soft Carrying Case (2852S and 2853S).
44991/035	Remote Applications Software: single user licence version.
44991/039	Remote Applications Software: site licence version.
54416/001	Drop and Insert Testguard (75 Ω unbalanced).
46883/852	Null Modem (female to female).
46883/824	Gender changer (female to female).
54127/309	Rack Mount Kit (2852S and 2853S only).
54717/039	Scriptos printer
54311/216	RS-232 special printer lead
46662/260	Scriptos paper, 10 packs

2854S / 2855S

PCM TRANSMIT INTERFACE

Framing and bit rates	
As 2850B, 2851 PLUS:	
34368 kbit/s	- G.751 asynchronous.
139264 kbit/s	- G.751 asynchronous.
Permitted combinations of bit rates	2048 & 8448 & 34368 & 139264 kbit/s or 704 & 2048 & 8448 & 139264 kbit/s or 1544 & 2048 & 8448 & 34368 & 139264 kbit/s or 704 & 2048 & 8448 & 1544 & 3152 & 6312 & 34368 & 139264 kbit/s.
AIS	
Unframed	All ones signal.
Framed	
139264 kbit/s	All ones signal transmitted in a selected 2048, 8448 or 34368 kbit/s tributary.
34368 kbit/s	All ones signal transmitted in a selected 2048 or 8448 kbit/s tributary.
8448 kbit/s	All ones signal transmitted in a selected 2048 kbit/s tributary.
Clock source	Internal, external or derived from the received signal.
Internal	34 and 140 Mbit/s.
Accuracy	±2 ppm from 0°C to 55°C.
Offset	Steps of 5 and 25 ppm to a maximum of ±100 ppm.
External	
Unframed and Multiplex Clock	BNC Connector.
Range	6 MHz to 160 MHz.
Interface	Sine or square wave (ECL/TTL).
Impedance	50 Ω.
Clock output	TTL or ECL into 75 Ω.
Line codes	CMI. AMI (50% duty cycle). HDB3. NRZ.
Main outputs	34 and 140 Mbit/s.
Unbalanced	
Impedance	75 Ω.
Peak Voltage	
34 Mbit/s	1.0 V ±0.1 V.
140 Mbit/s	0.5 V ±0.05 V.
Space Voltage	0 V ±10% peak.
NRZ digital output	
34 and 140 Mbit/s.	Unframed only with external clock
Frequency Range	6 to 160 Mbit/s.
Level	TTL or ECL to 50 Mbit/s. ECL above 50 Mbit/s.
Connector	Data - main digital output BNC. Clock - BNC on rear panel.
Test patterns	
Insertion	
Single Channel	Selected 64 kbit/s channel of framed signal at 2048 kbit/s or 8448 kbit/s (G.744). Selected 64 kbit/s channel of 2048 kbit/s tributary (8, 34 and 140 Mbit/s output), or 8448 kbit/s (G.744) tributary (34 and 140 Mbit/s output).

n × 64 kbit/s Channel	Selected 64 kbit/s channel of framed signal at 2048 kbit/s or 8448 kbit/s (G.744). Selected 64 kbit/s channel of 2048 kbit/s tributary (8,34 and 140 Mbit/s output). Channel distribution can be contiguous or non-contiguous.
2048 kbit/s Tributary	Selected 2048 kbit/s tributary (8, 34 and 140 Mbit/s output).
8448 kbit/s Tributary	Selected 8448 kbit/s Tributary (34 and 140 Mbit/s output).
34368 kbit/s Tributary	Selected 34368 kbit/s tributary (140 Mbit/s output).
Unframed	Unframed signal.
PRBS	
34 and 140 Mbit/s	$2^{15}-1$. $2^{18}-1$. $2^{20}-1$. $2^{23}-1$. $2^{25}-1$. $2^{28}-1$. $2^{31}-1$.
All zeros	Continuous sequence of 0000.
All ones	Continuous sequence of 1111.
Alternating	Alternating sequence of 1010.
Word	User programmable sequence of 24 (34 and 140 Mbit/s only), 16 or 8 bits.
8 + 8 Word	Two user programmable 8 bit sequences are alternated by an external TTL input. The changeover occurs at the end of 8 bits (not at 34 or 140 Mbit/s).
1 kHz 0 dBm0 sine wave	Digital representation of a sinusoidal signal of 1 kHz at a nominal level of 0 dBm0, coded according to A-Law, inserted into single channel. This facility is available for 704 and 2048 kbit/s systems only.
Fill patterns	All other channels in single channel and n × 64 kbit/s framed operation PRBS, $2^{15}-1$. User programmable 8-bit word.
34 and/or 8 and/or 2 Mbit/s tributaries	All 1s. All 0s. PRBS. Alternating 10. Copy of 2 or 8 or 34 Mbit/s test signal.
External voice and data	For framed and multiplex operation, an externally input 64 kbit/s data stream or a voice frequency signal can be inserted into one of the channels in the transmitted signal instead of a test pattern.
Data Input	Applies to frame structures at 704, 1544, 2048 and 8448 kbit/s (G.704/G.744). Applies to 2048 kbit/s tributaries within frame structures at 8448 kbit/s (G.742), 34 and 140 Mbit/s (G.751) and 8448 kbit/s (G.744) tributaries within 34 and 140 Mbit/s.
Data Input Interface	Codirectional to G.703. Contradirectional to G.703 (AMI 100% or Bipolar NRZ). X.21 (using DCE adapter cable accessory). NRZ (TTL level).
Voice frequency input	Applies to frame structures at 1544 and 2048 kbit/s. Applies to 2048 kbit/s tributaries within frame structures at 8448 kbit/s (G.742), 34 and 140 Mbit/s (G.751).
Range	0.3 to 3.4 kHz.
Encoding	A-Law for 2048 kbit/s. μ-Law for 1544 kbit/s.
Impedance	600 Ω balanced.
Max Input Level	+3 dBm0.
Error injection	34 and 140 Mbit/s.
Target	Test pattern only. Framing only.
Error Type	
Binary	Bits are inverted before coding.
Code	Code errors are injected by changing ±1 to 0 and 0 to ±1 where the polarity of the inserted mark is the same as the polarity of the last mark transmitted. There is no injection into CMI line code at 140 Mbit/s.

Injection Mode	
Singly	By keypress.
Fixed rate	
34 Mbit/s	9×10^{-2} to 1×10^{-8} (pattern and code). 9×10^{-3} to 1×10^{-7} (frame).
140 Mbit/s	9×10^{-3} to 1×10^{-9} (pattern). 9×10^{-3} to 1×10^{-7} (frame).
Access to structure bits	
34 and 140 Mbit/s	Frame alignment strategy. Change unassigned, distant and alarm bits.

PCM RECEIVE INTERFACE

Framing and bit rates	As Transmitter.
Permitted combinations of bit rates	As Transmitter.
Frequency Tolerance	As 2850B, 2851 PLUS:
34368 kbit/s	±60 ppm.
139264 kbit/s	±60 ppm.
Line codes	As Transmitter.
Digital input	
Connector	BNC.
Impedance	75 Ω unbalanced.
NRZ digital input	34 and 140 Mbit/s.
Unframed only	
Frequency Range	6 to 160 Mbit/s.
Level	TTL or ECL to 50 Mbit/s. ECL above 50 Mbit/s.
Connector	Data - main digital input BNC. Clock - BNC on rear panel.
Input modes and sensitivity	34 and 140 Mbit/s.
Terminated	Terminates the line.
Sensitivity	±1 V (34 Mbit/s), ±0.5 V (140 Mbit/s) nominal. +3 dB −12 dB cable attenuation. +3 dB −18 dB linear attenuation.
Monitor	Connects to a protected monitor point.
Sensitivity	Nominal attenuation of −20 to −35 dB. +3 dB −6 dB cable attenuation. +3 dB −12 dB linear attenuation. Up to a maximum of 38 dB
Test patterns	
Source	
Single Channel	Selected 64 kbit/s channel of framed signal Selected 64 kbit/s channel of 2048 kbit/s tributary or 8448 kbit/s (G.744) tributary (34 and 140 Mbit/s input).
n × 64 kbit/s Channel	Selected n × 64 kbit/s channel of framed signal at 2048 kbit/s or 8448 kbit/s (G.744).Selected n × 64 kbit/s channel of 2048 kbit/s tributary (8, 34 and 140 Mbit/s input).(8 and 34 Mbit/s input - option 14 fitted). Channel distribution can be contiguous or non-contiguous.
2048 kbit/s Tributary	Selected 2048 kbit/s tributary. (8, 34 and 140 Mbit/s input).
8448 kbit/s Tributary	Selected 8448 kbit/s tributary. (34 and 140 Mbit/s input).
34368 kbit/s Tributary	Selected 34368 kbit/s tributary (140 Mbit/s input).
Unframed	Unframed signal.
PRBS	
34 and 140 Mbit/s	$2^{15}-1$. $2^{18}-1$. $2^{20}-1$. $2^{23}-1$. $2^{25}-1$. $2^{28}-1$. $2^{31}-1$.
Repetitive Word	Any word which repeats over a 24 bit (34 and 140 Mbit/s only), 16 or 8 bit sequence.
Channel extract	For framed single channel and demultiplex operation a selected 64 kbit/s channel is extracted from the received signal and output as a data signal or voice frequency signal. The audio output is also available on the internal loudspeaker.
Data Output	Applies to frame structures at 704, 1544 and 8448 kbit/s (G.704/G.744). Applies to 2048 kbit/s tributaries within frame structures at 8448 kbit/s (G.742), 34 and 140 Mbit/s (G751) and 8448 kbit/s (G.744) tributaries within 34 and 140 Mbit/s.

Data Output Interface	Codirectional to G.703. Contradirectional to G.703 (100% AMI or Bipolar NRZ). X.21. (using DCE adapter cable accessory). NRZ (TTL level).
Frame or AIS alarm detected	All 1's transmitted.
Signal loss detected	Outputs are off.
Clock Output	64 kHz (TTL).
Voice Frequency Output	Applies to frame structures at 1544 and 2048 kbit/s. Applies to 2048 kbit/s tributaries within frame structures at 8448 kbit/s (G.742), 34 and 140 Mbit/s (G.751).
Range	0.3 to 3.4 kHz.
Decoding	A-Law for 2048 kbit/s. μ-Law for 1544 kbit/s.
Impedance	600 Ω balanced.
Status indicators	A combination of LEDs and an alarm page indicate frame structure alarm conditions for the input signal and, for demultiplex operation, the tributaries selected. For demux mode hierarchical AIS, FRAME and DISTANT alarms are ORed to the LED indicator.
Unassigned framing bits	The state of the unassigned bits is displayed.
Sync outputs	PRBS.
Polarity	Negative pulse.
Interface	TTL.

DATA TEST INTERFACES

X.21 (X.24), RS-449 (V.36), V.35 and RS-232	As 2851 (2855S only).
Codirectional, Contradirectional and Eurocom D/1 (Option 22)	As 2851.
Test patterns	As 2851.
Error injection	As 2851.
Alarms	As 2851.
Sync outputs	As 2851.
Errors output	As 2851.

MEASUREMENTS

Error types	
PCM Interfaces	Line Code Errors (Bipolar Violations). Pattern Errors. Framing Errors. CRC Errors.
Data Interfaces	Pattern Errors.
- Line Code Errors	Measured on input signal rate.
- Framing Errors	Measured at each hierarchical level for the demultiplex path selected.
- Pattern Errors	Measured for the selected test pattern which can be a tributary, 64 kbit/s, n × 64 kbit/s channel, or unframed.
- CRC Errors	Measured as appropriate for selected input signal, or 2048 kbit/s tributaries.
Main parameters	As 2851.
Additional parameters	As 2851.
G.821 error performance	As 2851.
Stored results	As 2851.
Propagation delay	34 and 140 Mbit/s.
Range	Up to 8 seconds.
Resolution	1 bit. 4 bits at 140 Mbit/s.
Update rate	Typically up to 8 seconds.
Signalling	As 2851.
Bit rate measurement	The bit rate is measured every other second and displayed to the nearest 1 Hz, or 4 Hz at 140 Mbit/s.
Accuracy	±2 ppm ±1 count.
Digital signal level measurement	The amplitude of the incoming digital signal is measured and displayed in Volts peak and dB relative to nominal.
34 and 140 Mbit/s	
Range	+3 to −40 dB.
Accuracy	+3 to −30 dB ±2 dB. −30 to −40 dB +3 dB.
2 channel synchronisation measurement	As 2851.

GENERAL CHARACTERISTICS
As 2851 except:

IEEE 488 (option)	Used for remote control or printer operations.
Power requirements	
A.C. Operation	
A.C. Voltage	105 - 120 V ~ (Limit 90 - 132 V~). 210 - 240 V ~ (Limit 188 - 265 V~).
Frequency	50 - 60 Hz (Limit 45 - 66 Hz).
Consumption	80 VA maximum.
D.C. Operation (Option)	
48 V	
Range	±36 to ±60 V, 2.0 A max.
Battery Operation (Option)	
Operating time	1.5 hours with backlight timeout of 5 minutes for temperature range of 17 to 27°C.
Charge time	15 hours.
Temperature range for full nominal charge	10 to 30°C.
Temperature range for full nominal discharge	0 to 50°C.
Limit range of operation	
Charge	0 to 35°C.
Discharge	0 to 50°C.
Weight	2.7 kg.
Dimensions and weight	

Height	Width	Depth	Weight
197 mm	345 mm	477 mm	8 kg

OPTIONS AND ACCESSORIES

Versions	Description
2854S	Digital Transmission Analyzer
2855S	Digital Communications Analyzer

Note that 2854S does not provide RS-232, X.21, RS-449 and V.35 test interfaces.

Option	Allowed Combinations					Description
01	★	★	★	★	★	2, 8, 34 and 140 Mbit/s framed and Mux/Demux.
02			★			Add 1544 kbit/s (T1).
03				★		Add 704 kbit/s.
04					★	Add 704 kbit/s, T1, T1C, T2 (No ALBO).
25		★				Eurocom D/1 IB5 and Eurocom D/1 IB6, 704, 2048, 8448 kbit/s (no ALBO), 34 and 140 Mbit/s Framed and Mux/Demux.
08	†	†	†	†	†	French key panel.
09	†	†	†	†	†	1.6/5.6 Connectors.
12	†	†	†	†	†	Battery.
13	†	†	†	†	†	IEEE-488.
19	†	†	†	†	†	DC Input - ±36 to ±60 V (includes cable).
22	†	†	†	†	†	Eurocom D/1 IB6.
26	†	†	†	†	†	V.11 data rate to 9 Mbit/s

★ Basic options
† Additional options
Option 26 is available only on 2855S.

Part Number	Supplied Accessories
43129/003	Supply lead.
41690/485	Stowage Cover.
46884/604	Audio Jack Plug (Qty 2).
46884/403	15 way D-Type Connector.
54311/125	X.21 Adapter Lead - V.11, DTE.
54311/127	RS-449 Adapter Lead - V.11, DTE.
54311/131	V.35 Adapter lead - DTE.
46882/128	Operating Manual.
46882/127	Introductory Guide.

Part Number	Optional Accessories
46880/004	Service Manual
54311/126	X.21 Adapter Lead - V.10, DTE, female.
54311/140	X.21 Adapter Lead - V.11, DCE, female.
54311/141	X.21 Adapter Lead - V.10, DCE, female.
54311/128	RS-449 Adapter Lead - V.10, DTE, female.
54311/142	RS-449 Adapter Lead - V.11, DCE, female.
54311/143	RS-449 Adapter Lead - V.10, DCE, female.
54311/144	V.35 Adapter Lead - DCE, female.
54311/152	RS-232 Adapter Lead - DCE, female.
54311/121	RS-232 Lead - male to male - 25 way D-Type - 1.5 m.
54311/122	X.21 Lead - male to male - 15 way D-Type - 1.5 m.
54311/147	RS-449 Lead - male to male - 37 way D-Type - 1.5 m.
54311/148	V.35 Lead - male to male - 34 way MRAC - 1.5 m.
54311/130	Co/Contradirectional Test Lead - 15 way D-Type to free end.
43129/189	IEEE-488 Lead.
46662/387	RS-232 Null Modem (female to female).
46662/373	Printer P40S.
46662/374	P40S Charger (UK) 240 V.
46662/538	P40S 10 - 72 V to 6 V adapter.
46883805	Signal Lead balanced (CF-CF).
43139/042	Signal Lead (BNC-BNC), 1.5 m.
46662/388	BNC to 1.6/5.6 adapter.
46884/402	D-Type connector 25 way.
46662/192	Transit Case.
46662/499	Soft Carrying Case.
44991/035	Remote Applications Software: single user licence version.
44991/039	Remote Applications Software: site licence version.
	continued /.

Part Number	Optional Accessories *(contd.)*
54416/001	Drop and Insert Testguard (75 Ω unbalanced).
46883/852	Null Modem (female to female). .

46883/824	Gender changer (female to female).
54127/309	Rack Mount Kit.
54717/039	Scriptos printer
54311/216	RS-232 special printer lead
46662/260	Scriptos paper, 10 packs

EC Declaration of Conformity

Certificate Ref. No.: DC204

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way, Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2850B
Options:	1, 2, 3, 4, 8, 9, 10, 11, 12,15, 16, 17, 18, 22, 24 & 25.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	**Title:**
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:
IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:
IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place)

23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

EC Declaration of Conformity

Certificate Ref. No.: DC205

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way,** **Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2850BS
Options:	1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 22, 24 & 25.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	Title:
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:

IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:

IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place)

23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

EC Declaration of Conformity

Certificate Ref. No.: DC206

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way, Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2851
Options:	1, 2, 3, 4, 8, 9, 10, 11, 12, 15, 16, 17, 18, 22, 24, 25 & 26.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	Title:
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:
IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:
IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place)

23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

EC Declaration of Conformity

Certificate Ref. No.: DC207

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way,** **Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2851S
Options:	1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 22, 23, 24, 25 & 26.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	**Title:**
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:

IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:

IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place)

23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

EC Declaration of Conformity

Certificate Ref. No.: DC208

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way,** **Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2852
Options:	1, 2, 3, 4, 8, 9,12,14, 15, 16, 17, 18, 22 & 25.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	**Title:**
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:

IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:

IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place)

23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

EC Declaration of Conformity

Certificate Ref. No.: DC209

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way, Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2852S
Options:	1, 2, 3, 4, 8, 9,12, 13, 14, 15, 16, 17, 18, 22 & 25.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	Title:
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:
IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:
IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place) 23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

EC Declaration of Conformity

Certificate Ref. No.: DC210

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way,** **Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2853
Options:	1, 2, 3, 4, 8, 9,12, 14,15, 16, 17, 18, 22, 25 & 26.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	Title:
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:
IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:
IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place)

23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

EC Declaration of Conformity

Certificate Ref. No.: DC211

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way,** **Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2853S
Options:	1, 2, 3, 4, 8, 9,12, 13, 14,15, 16, 17, 18, 22, 25 & 26.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	**Title:**
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:

IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:

IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place)

23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

EC Declaration of Conformity

Certificate Ref. No.: DC212

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way, Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2854S
Options:	1, 2, 3, 4, 8, 9, 12, 13, 18, 19, 22 & 25.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	**Title:**
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:

IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:

IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place)

23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

EC Declaration of Conformity

Certificate Ref. No.: DC213

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way, Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description:	Digital Transmission and Communications Analyzers
Model No.	2855S
Options:	1, 2, 3, 4, 8, 9, 12, 13, 18, 19, 22, 25 & 26.

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	Title:
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety:
IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:
IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place) 23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

Chapter 2
INSTALLATION

Contents

List of figures

Ventilation

If the 2851 is fitted with a plastic cover it should be removed before it is connected to the AC mains supply. The instrument is air-cooled with fan assistance, via vents. Air is ducted over the heat producing elements and is expelled by the fan through the rear panel grill. These air vents must not be obstructed while the instrument is in use.

Carrying handle

2850BS, 2851S, 2852S, 2853S, 2854S & 2855S

The carrying handle can be repositioned to tilt the instrument or to be stowed above or below.

To reposition the handle press the boss in the centre of both sides of the handle, move it to the required angle (in steps of 30 degrees) and release to lock.

Connecting to AC supply

Voltage selector and fuses

Before connecting the instrument to the AC supply, check the position of the voltage selector on the rear panel. The instrument is normally supplied with the selector set to the range 210 V~ to 240 V~ and fitted with either the T630mAL250V (metal case instrument) or T250mAL250V (plastic case instrument) cartridge type fuses in screw cap holder/s.

To change the selection on the plastic case versions to the 105 V to 120 V range, turn the slot in the rotary switch to the alternative position.

To change the selection on the metal case versions to the 105 V to 120 V range, remove the plate surrounding the selector switch (2 screws) and slide the switch across to the alternative position. Reverse the plate and refit it to the rear panel.

For 105 V~ to 120 V~ range supply change the supply fuse/s to T1AL250V (metal case instrument) or T400mAL250V (plastic case instrument).

Power cords

This instrument is a Safety Class 1 product and therefore must be earthed. Use the supplied power cord or an appropriate replacement. Make sure the instrument is plugged into an outlet socket with a protective earth contact.

The detachable power cord is the instrument's disconnecting device, but if the instrument is integrated into a rack or system, an external power switch or circuit breaker is required. Whichever is the disconnecting device, make sure it can be easily reached by the operator and that it is accessible at all times.

64 kbit/s connections

External connections are made via the 15 way D-type connector mounted on the plastic case rear panel, metal case front panel.

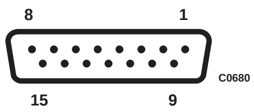


Fig. 2-1 64 kbit/s connector contact assignments

The 64 kbit/s connector interfaces the codirectional/contradirectional data or the Eurocom system data (if Option 22 is fitted).

Pin	**Codirectional**		**Contradirectional and Eurocom**	
1,9	Transmit Data	OUT	Transmit Data	OUT
3,11	Receive Data	IN	Receive Data	IN
5,13			Transmit Clock	IN
7,15			Receive Clock	IN
4,12			Transmit Clock	OUT
2,6,8,14	Ground		Ground	

RS-232 Test connections

External connections are made via the 25 way D-type connector mounted on the plastic case rear panel, metal case front panel.

For DTE testing connections are made directly to this connector. For DCE testing connections are made via a short adapter lead (male to female) which plugs in to this connector.

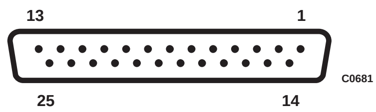


Fig. 2-2 RS-232 connector contact assignments

Pins	From DTE (to DCE)	Circuit	Pins	To DTE (from DCE)	Circuit
2	TD Transmit Data	103	3	RD Receive Data	104
4	RTS Request to Send	105	5	CTS Clear to Send	106
20	DTR Data Terminal Ready	108.2	6	DSR Data Set Ready	107
			8	RLSD Received Line Signal Detector	109
24	TT Transmit Timing	113	15	TT Transmit Timing	114
			17	RT Receiver Timing	115
21	RL Remote Loopback	140	25	TM Test Mode	142
18	LL Local Loopback	141			
7	Signal Ground				
1	Protected Ground				

DTR/DSR = DTR only on DTE cables, DSR only on DCE cables, both ON.

Data interfaces connections X.21, RS-449, V.35

External connections are made via short adapter leads which plug in to the 50 way type 57 connector mounted on the plastic case rear panel, metal case front panel. The adapter lead is selected to present the appropriate interface connector.

X.21 - DTE/DCE interface connector, 15 way D-type

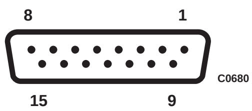


Fig. 2-3 X.21 Interface connector contact assignments

Pins	From DTE (to DCE)	Circuit	Pins	To DTE (From DCE)	Circuit
2,9	Transmit	T	4,11	Receive	R
			6,13	Timing	S
3,10	Control	C	5,12	Indication	I
8	Ground				

For unbalanced operation the second pin of each pair is ground.

RS-449 - DTE/DCE interface connector, 37 way D-type

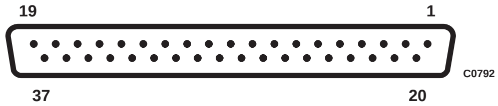


Fig. 2-4   RS-449 Interface connector contact assignments

Pins	From DTE (to DCE)	Circuit	Pins	To DTE (From DCE)	Circuit
4,22	SD Send Data	103	6,24	RD Receive Data	104
17,35	TT Tx Timing	113	8,26	RT Rx Timing	115
			5,23	ST Send Timing	114
7,25	RS Request To Send	105	9,27	CS Clear To Send	106
12,30	DTR Data Terminal Ready	108/2	11,29	DSR Data Set Ready	107
19	Signal Ground				

For unbalanced operation the second pin of each pair is ground.

DTR/DSR = DTR only on DTE cables, DSR only on DCE cables, both ON.

V.35 -DTE/DCE interface connector, 34 way MRAC

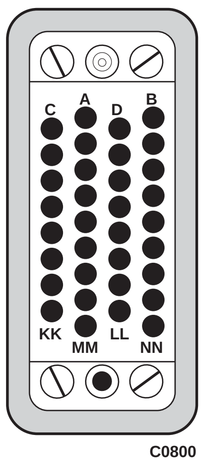


Fig. 2-5   V.35 Interface connector contact assignments

Pins	From DTE (to DCE)	Circuit	Pins	To DTE (From DCE)	Circuit
P,S	TD Transmit Data	103	R,T	RD Receive Data	104
U,W	TT Transmit Timing	113	V,X	RT Receive Timing	115
			Y,AA	TT Transmit Timing	114
C	RS Request to Send	105	D	CS Clear to Send	106
H	DTR Data Terminal Ready	108/2	E	DSR Data Set Ready	107
B	Ground				

DTR/DSR = DTR only on DTE cables, DSR only on DCE cables, both ON.

Structured data interfaces connections

Option for 2850B(S) & 2851(S)

External connections for three types of interface are available via three 15 way D-type connectors mounted on the rear panel.

Bal 120 connections

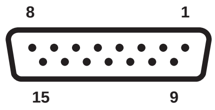


Fig. 2-6 Bal 120 connector contact assignments

Pin

1,9 Transmit Data Out
2,10 Transmit D & I Data In
3,11 Receive Data In
4,12 Transmit Clock Out
5,13 Transmit Clock In
6,14 Receive Clock Out
7,15 Receive Clock In
8 Ground

V.11 connections

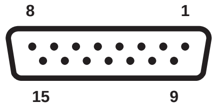


Fig. 2-7 V.11 connector contact assignments

Pin

1,9 Transmit Data Out
2,10 Transmit D & I Data In
3,11 Receive Data In
4,12 Transmit Clock Out
5,13 Transmit Clock In
6,14 Receive Clock Out
7,15 Receive Clock In
8 Ground

TTL connections

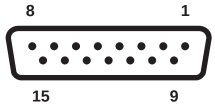


Fig. 2-8 TTL connector contact assignments

Pin

1 Transmit Data Out
2 Transmit D & I Data In
3 Receive Data In
4 Transmit Clock Out
5 Transmit Clock In
6 Receive Clock Out
7 Receive Clock In

8,9,11,13 Ground
10,12,14 Not connected

AUX connections

External connections are made via the 25 way D-type connector mounted on the rear panel.

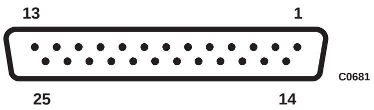


Fig. 2-9 AUX connector contact assignments

Pin		Pin	
1	Ground	14	Rx NRZ Data In
2	Ground	15	Rx NRZ Clk In
3	External TTL Clk In	16	Errors Out
4	Alarm Extension Out	17	
5	Tx PRBS Sync	18	Tx TTL Data Out
6	Rx PRBS Sync	19	Tx 64kbit Data In or Rx TTL Data In
7	+5 V	20	Rx 64kbit Clock Out
8	Pattern Alternate In	21	Rx 64kbit Data Out
9	Ground	22	Tx NRZ Data Out
10	Ground	23	Tx NRZ Clk Out or Tx TTL Clk Out
11	Ground	24	Rx Demux Clk Out
12	Ground	25	Rx Demux Data Out
13	Ground		

Voice frequency VF in & out connections

External connections are made using 3 way miniature jack plugs connected via the sockets mounted on the plastic case rear panel, metal case front panel. Audio circuits are balanced - connect wires to tag and pin.

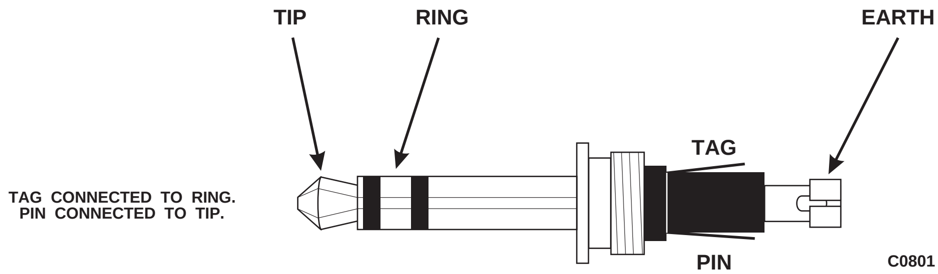


Fig. 2-10 Miniature jack plug connections

RS-232 control connections

External connections are made via the 25 way D-type connector mounted on the rear panel.

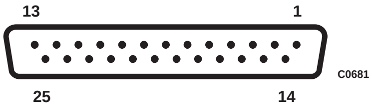


Fig. 2-11 RS-232 control connector contact assignments

Pin		Pin	
1	Protective ground	5	Clear to send - CTS
2	Transmitted data - TXD	6	Data set ready - DSR
3	Received data - RXD	7	Signal ground - SG
4	Request to send - RTS	8	Receive line signal detect - RLSD
		20	Data terminal ready - DTR

34 Mbit/s NRZ connections - 2852(S) & 2853(S)

External connections are made via the 15 way D-type connector mounted on the rear panel.

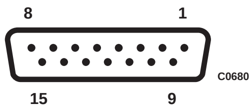


Fig. 2-12 34 Mbit/s NRZ connector contact assignments

Pin		
2-8	Ground	
13	Transmit Clock In	NRZ
11	Transmit Clock Out	NRZ
12	Transmit Data Out	NRZ
15	Receive Clock In	NRZ
14	Receive Data In	NRZ
10	Transmit Clock In	HDB3/AMI clock - 50 Ω
1,9	Not connected	

DC supply option connections

External connections are made via the 3 way D-type connector mounted on the rear panel using the supplied interconnection lead. The two unterminated wires are connected to the DC supply as detailed below. Label adjacent to the connector identifies which of the available options is fitted.

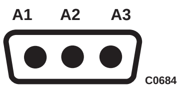


Fig. 2-13 DC SUPPLY connector contact assignments

Pin A1 Black –ve. Pin A2 Red +ve.

Option

11	±10V to ±18V
17	±11V to ±20V

Pin A1 Black –ve. Pin A3 Red +ve.

Option

10	±20V to ±72V
15	±36V to ±72V
16	±20V to ±36V
19	±36V to ±72V

GPIB option connections

External connections are made via the 24 way type 57 connector mounted on the metal case rear panel, see Fig. 2-15.

Connection to equipment which has a 24 way bus connector to IEEE Standard 488 can be made with the GPIB lead assembly 43129-189U, available as an optional accessory. An IEEE to IEC adapter 46883-408K is also available for interfacing with systems using a 25 way bus connector to IEC Recommendation 625, see Fig. 2-14.

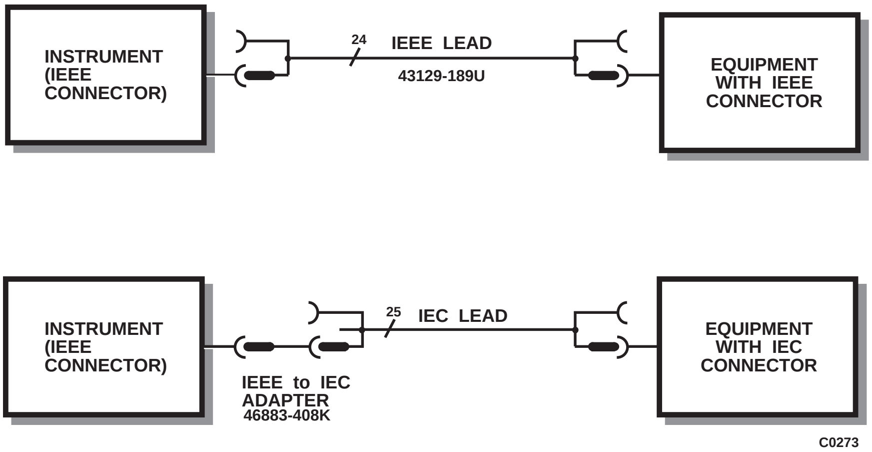


Fig. 2-14 GPIB interconnections

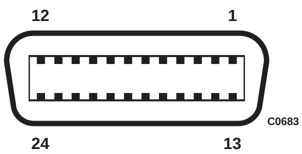
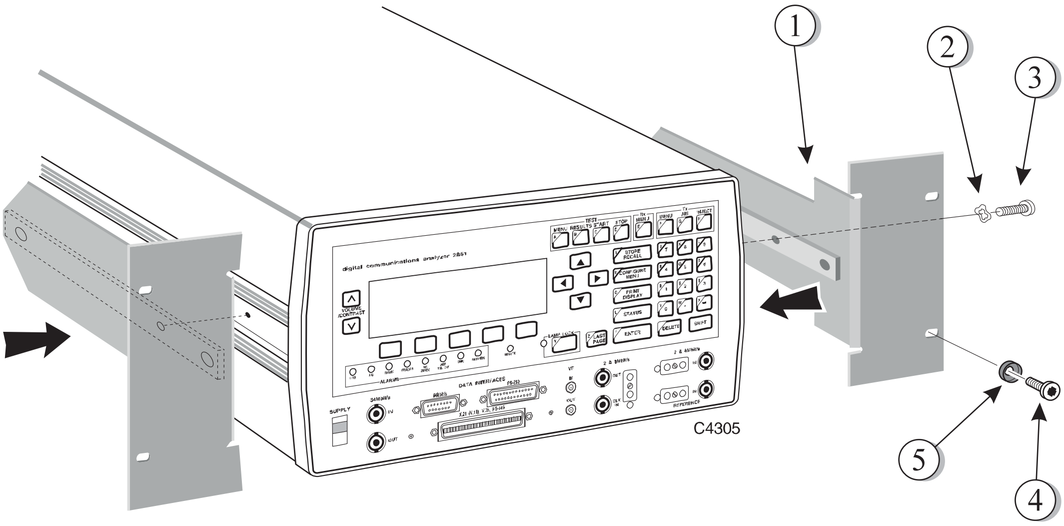


Fig. 2-15 GPIB connector contact assignments

Pin		Pin	
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI	17	REN
6	DAV	18	Forms twisted pair with 6
7	NRFD	19	Forms twisted pair with 7
8	NDAC	20	Forms twisted pair with 8
9	IFC	21	Forms twisted pair with 9
10	SRQ	22	Forms twisted pair with 10
11	ATN	23	Forms twisted pair with 11
12	Ground shield	24	Logic ground

Rack mounting arrangements for metal case versions

Rack mounting kit 54127/309Z is available to mount single instruments with the combination forming a full rack-width assembly as shown below.



List of parts

	Description	Part no.	Qty.
(1)	Rack mounting bracket	35906/978	2
	fitted with		
	Rack mounting strip	34901/022	2
	Screw csk-hd hex skt, M5	21817/704	4
	Washer crinkle, M5	21177/652	4
	Nut full, hex, M5	21882/112	4
(2)	Washer crinkle, M5	21177/652	2
(3)	Screw pan-hd, slot, M5, 16mm lg	21837/565	2
(4)	Screw pan-hd, pozi, M6, 16mm lg	21836/117	4
(5)	Washer cup, M6, nylon	21186/636	4

Fitting

Lever off the cap moulding from each tilt handle boss, remove the securing screw and detach the handle and fittings. Remove the four feet from the bottom cover by pulling out the studs and releasing the revealed securing screws.

Fix a bracket assembly to each side of the case by locating the mounting strip in the side of the case and securing with an M5, 16mm pan head slotted screw and crinkle washer, (3), (2).

Mount and secure the assembly in the rack using the 4 M6 pan head pozidrive screws and M6 nylon cup washers, (4), (5).

Routine safety testing and inspection

In the UK the ‘Electricity at Work Regulations” (1989) section 4(2) places a requirement on the users of equipment to maintain it in a safe condition. The explanatory notes call for regular inspections and tests together with a need to keep records.

The following electrical tests and inspection information is provided for guidance purposes and involves the use of voltages and currents that can cause injury. It is important that these tests are only performed by competent personnel.

Prior to carrying out any inspection and tests the instruments must be disconnected from the mains supply and all external signal connections removed. All tests should include the instrument’s own supply lead, all covers must be fitted and the supply switch must be in the ‘ON’ position.

The recommended inspection and tests fall into three categories and should be carried out in the following sequence:

1. Visual inspection
2. Earth Bonding Test (Class I equipment only)
3. Insulation Resistance test.

1. Visual Inspection

A visual inspection should be carried out on a periodic basis. This interval is dependant on the operating environment, maintenance and use, and should be assessed in accordance with guidelines issued by the Health and Safety Executive (HSE). As a guide, this instrument when used indoors in a relatively clean environment would be classified as ‘low risk’ equipment and hence should be subject to safety inspections on an annual basis. If the use of the equipment is contrary to the conditions specified, you should review the safety re-test interval.

As a guide, the visual inspection should include the following where appropriate:

Check that the equipment has been installed in accordance with the instructions provided (e.g. that ventilation is adequate, supply isolators are accessible, supply wiring is adequate and properly routed).

The condition of the mains supply lead and supply connector(s).

Check that the mains supply switch isolates the instrument from the supply.

The correct rating and type of supply fuses.

Security and condition of covers and handles.

Check the supply indicator functions (if fitted).

Check the presence and condition of all warning labels and markings and supplied safety information.

Check the wiring in re-wireable plugs and appliance connectors.

If any defect is noted this should be rectified before proceeding with the following electrical tests.

2. Earth Bonding Tests (Class I Equipment only)

Earth bonding tests should be carried out using a 25A (12V maximum open circuit voltage) DC source. Tests should be limited to a maximum duration of 5 seconds and have a pass limit of 0.1 Ω after allowing for the resistance of the supply lead. Exceeding the test duration can cause damage to the equipment. The tests should be carried out between the supply earth and exposed case metalwork, no attempt should be made to perform the tests on functional earths (e.g. signal carrying connector shells or screen connections) as this will result in damage to the equipment.

3. Insulation tests

A 500 V DC test should be applied between the protective earth connection and combined live and neutral supply connections with the equipment supply switch in the ‘on’ position. It is advisable to make the live/neutral link on the appliance tester or its connector to avoid the possibility of returning the equipment to the user with the live and neutral poles linked with an ad-hoc strap. The test voltage should be applied for 5 seconds before taking the measurement.

Aeroflex Ltd employs reinforced insulation in the construction of its products and hence a minimum pass limit of 7 MΩ should be achieved during this test.

Where a DC power adapter is provided with the equipment, the adapter must pass the 7 MΩ test limit.

We do not recommend dielectric flash testing during routine safety tests. Most portable appliance testers use AC for the dielectric strength test which can cause damage to the supply input filter capacitors.

4. Rectification

It is recommended that the results of the above tests are recorded and checked during each repeat test. Significant differences between the previous readings and measured values should be investigated.

If any failure is detected during the above visual inspection or tests, the equipment should be disabled and the fault should be rectified by an experienced Service Engineer who is familiar with the hazards involved in carrying out such repairs.

Safety critical components should only be replaced with equivalent parts, using techniques and procedures recommended by Aeroflex International Ltd.

The above information is provided for guidance only. Aeroflex International Ltd designs and constructs its products in accordance with International Safety Standards such that in normal use they represent no hazard to the operator. Aeroflex international Ltd reserves the right to amend the above information in the course of its continuing commitment to product safety.

Cleaning

Before commencing any cleaning, switch off the instrument and disconnect it from the supply. The exterior surface of the case may be cleaned using a soft cloth moistened in water. Do not use aerosol or liquid solvent cleaners.

Cleaning the LCD Window

To prevent damage to the LCD window, care should be taken not to scratch the surface during use and also when cleaning. The LCD window should be cleaned by wiping a slightly damp, soft, lint-free cloth gently over the surface. To remove grease or smears, use a clean cotton cloth moistened with Heptane. No other cleaning agents should be used. Clean the window using either horizontal or vertical strokes, NEVER a circular action.

Chapter 3
LOCAL OPERATION

Contents

List of figures

Introduction

The 2851 is operated by pressing keys to select parameter options/values or test results in pages displayed by the liquid crystal display. Hard keys always select the same function whereas soft key functions selected are determined by the menu displayed. Numerical keys are used to set parameter values.

Key functions are described under the heading 'Control and display panel features'. The procedure for selecting options and values is described in 'Editing procedures'. Page functions are described under their page group headings.

The 2851 software ensures only allowed measurement parameters and instrument settings can be selected and edited.

Reference to 2851 includes all versions unless stated otherwise.

Descriptions, selections and examples in this chapter cover all instrument versions and options. Disregard those that are not applicable to your instrument.

Conventions

The following conventions are used in this chapter:

[ENTER]	Capitals in square brackets indicate hard key titles.
[FRAMED]	Italics in square brackets indicate soft key titles eg. *[FRAMED]* means the soft key below the FRAMED title box at the bottom of the display page.
New Value	Italics refer to messages on the display.

Control and display panel features

Refer to Fig. 3-1.

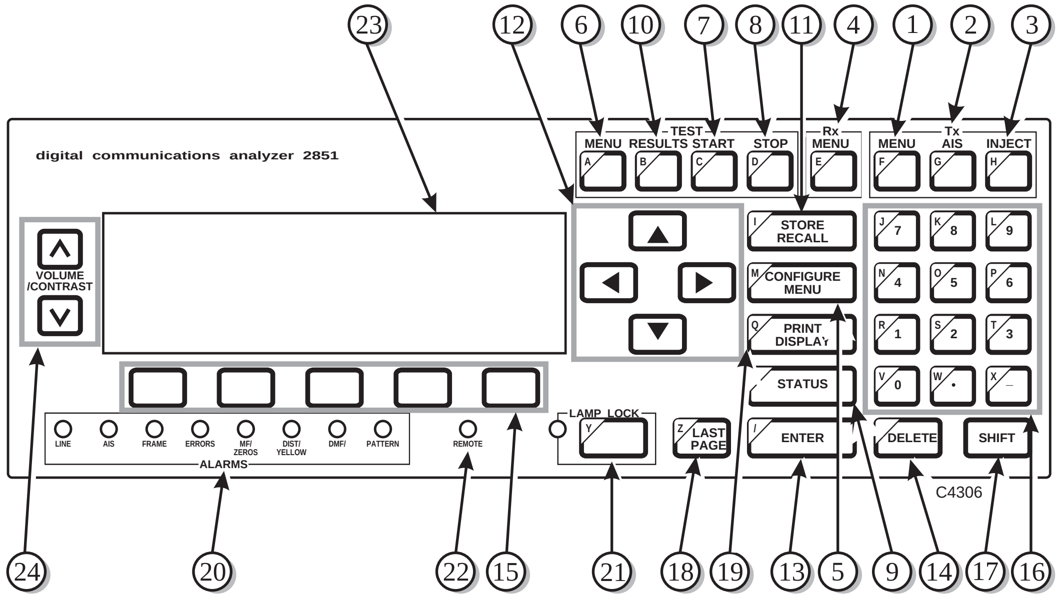


Fig. 3-1 Control and display panel

1 [TX-MENU/F]

Displays a menu page for selecting transmitter PCM or Data or Structured Data parameter options.

PCM parameters include:-

Transmitter on/off	Test pattern	Sequence tests
Digital system	Error injection	Loopback codes
Line code	AIS and zeros on/off	Overhead bits
Bit rate	Signalling channel	
Clock source	Signalling codes	

Data parameters include:-

Transmitter on/off	Async coding
Data system	Test pattern
Bit rate	Error injection
Clock source	Tx control lines

Structured Data parameters include:-

Interface	Clock source
Structured Data system	Alignment lock on/off
Line code	Error injection
Bit rate	AIS on/off
Data rate	
Test pattern	

2 [TX-AIS/G]

When pressed, replaces the transmitted signal with an unframed all ones signal. The number of zeros can be 0 or in the range 1×10^{-7} to 9×10^{-2} programmable in the TX-CLOCK, AIS page.

3 [TX-INJECT/H]

Injects a single error or a single error burst per key press. PCM system errors can be bit or bipolar violations in test pattern, frame or CRC bits. Bit errors can be injected before or after CRC calculation. Data errors are bit errors. Structured Data errors are test pattern, frame or envelope bit errors. Error injection parameters are set up in the TX-ERROR INJECTION page.

4 [RX-MENU/E]

Displays a menu page for selecting PCM or Data or Structured Data receiver parameter options.

PCM parameters include:-

Digital system	Signalling channel
Input mode	Monitor signalling codes
Line code	Monitor dialled digits
Received bit rate	Dialling errors
Receive pattern	Monitor overhead bits
Loudspeaker on/off	

Data parameters include:-

Data system
Receive pattern
Received bit rate
Rx control lines

Structured Data parameters include:-

Interface	Monitor status bits
Structured Data system	Monitor alarms
Receive pattern	Monitor input levels
Receive data rate	
Alignment lock on/off	

5 [CONFIGURE-MENU/M]

Displays a menu page for selecting configurations.

Configurations include:-

GPIB Port function (none, remote, printer)
RS-232 Port function (none, remote, printer, sharer or terminal).
Autoprint Events and what to print or send to RAM.
Receiver signalling parameters.
Real time and date.
Hardware items and options fitted
Miscellaneous options e.g. Autoskip cursor.
Voice encoding law.
Errors LED threshold.
Count code excess zeros.

6 [TEST-MENU/A]

Displays a menu page for selecting test options.

Test options include:-

Test Progress page which indicates the test start and stop, date and time, total measurement and total duration of power loss times.

Test Parameters which include:-

Test termination in real time or indefinite duration.

Major error type i.e.	For PCM systems - Line code, Pattern, Frame and CRC. For Data systems - Pattern only.
Error gating.	For Structured Data systems - Pattern and Frame.

Burst threshold and Buzzer for alarms or errors.

7 [TEST-START/C]

Initiates measurements and records results for errors, performance G.821, G.826 and M.2100, stored G.821, distribution, sync status, Slips and Bursts as defined by the conditions set-up. Clears results of previous test.

8 [TEST-STOP/D]

Terminates a test. Test results are retained for inspection and printing or storing until next test is started.

9 [STATUS/U]

Displays a summary of current instrument status.

Status includes Transmitter and Receiver status, results for the selected major error type, test type and Autoprint status.

10 [TEST-RESULTS/B]

Displays a menu page for selecting results of the last or currently running test. All test results are stored in non-volatile memory.

Test results include:-

Major error type selected
Total errors (All error types)
Error ratio (All error types)
Performance data errors G.821, G.826, M.2100
AIS detected.
Sync slips
Network delay
Octet slip measurements
Burst error measurements.
Frame, Pattern and CRC sync status.
Loss of signal events.
Histograms of error distribution with time.
Histograms of stored G.821 results with time.

11 [STORE-RECALL/I]

Displays a menu page for selecting one of 4 types of stores held in non-volatile memory.

User Configs store page displays the names of up to 18 stores entered by the user containing instrument settings and available for recall.

Fixed Configs store page displays the names of stores, available for recall only, containing factory programmed instrument settings. For details of the Default store see Appendix A.

Tests store page displays the names of up to 6 stores entered by the user containing complete sets of test results and available for recall.

Autoprints store page displays the names of up to 20 Autoprint text files entered by the user containing Interval/Event print information and available for recall to view and to send to the printer.

12 [▲] [▼] [◀] [▶]

Move position of highlight/cursor around the displayed text for up, down, left and right directions when allowed.

13 [ENTER//]

Moves to an 'edit' or 'status' page highlighted in a menu page. Enters numeric values or text typed by the user.

14 [DELETE/(space)]

Deletes alpha or numeric characters typed by the user one character per key press prior to pressing [ENTER].

15 Non-dedicated keys or 'soft' keys

Up to five options can be displayed at the bottom of a page. Press the soft key below the option required.

16 Numeric keys

Moves position of highlight to a corresponding numbered option in a menu page. Used in editing procedures for entering numerical values.

17 [SHIFT]

Selects alpha characters on dual function keys e.g. to select character 'Z', press [SHIFT] and [LAST PAGE]. These characters are used for entering new data values, when editing or as short cuts to certain toggle operations when not editing.

18 [LAST PAGE/Z]

Displays the page you selected prior to the current page. Can display up to ten contiguous previously selected pages.

19 [PRINT DISPLAY/Q]

Prints current displayed page on an externally connected printer.

Note [SHIFT] + [PRINT DISPLAY] enables a print of the Stored G.821 errors for the current selection of intervals when on any Stored G.821 page.

20 ALARMS

Eight LEDs illuminate to indicate specific alarm conditions on the received digital signal. Only the highest priority alarm is indicated. The LED extinguishes when the alarm condition clears unless [LAMPLOCK] key, item **21** is enabled.

The alarms are as follows:-

LINE	Signal loss.
AIS	Alarm indication signal or all ones signal, (PCM and Structured Data Option 24 only).
FRAME	Loss of frame alignment, (PCM and Structured Data Option 24 only).
ERRORS	Major error rate greater than user specified threshold selectable from 9×10^{-3} to 1×10^{-9}. Major error type set in Test-Parameters page. Threshold set in the Configure-Options page. Active during a test.
MF/ZEROS	Loss of multiframe alignment or more than 31 consecutive zeros, (PCM only).
DIST/YELL	Distant alarm or Yellow alarm, (PCM and Structured Data (X.50) Option 24 only).
DMF/	Distant multiframe alarm, (PCM only - not 2M/CnoMF or 2M/noMF systems). /ISDN alarm (PCM only 2M/CnoMF & 2M/noMF systems).
PATTERN	Loss of pattern synchronization.

21 [LAMPLOCK/Y] and LED

Press to enable LAMPLOCK mode and LAMPLOCK LED illuminates to indicate this condition. Active LAMPLOCK mode maintains (latches) an illuminated alarm LED after the alarm has been cleared.

To disable LAMPLOCK mode and reset any latched LEDs press [LAMPLOCK] again.

22 REMOTE LED

When illuminated, indicates the 2851 is under remote control and the keyboard is inoperable. When flashing, indicates battery option is fitted and display backlight is switched off, see Battery Operation section.

23 Liquid crystal display

An 8 line × 40 character plus graphics capability LCD with cold cathode backlight.

24 [VOLUME/CONTRAST] keys [∧] [∨]

Volume	-	Press these keys to select the required loudspeaker volume.
Contrast	-	Press these keys with [SHIFT] to select the required viewing angle for the LCD display.

Keyboard short cuts

These enable certain operations to be selected directly, bypassing normal menu selection. They are not available when editing.

Press [SHIFT] and

[T] - **T**x ON/OFF
[A] - **A**IS ON/OFF
[E] - **E**rror inject ENABLE/DISABLE
[P] - event **P**rint ON/OFF
[I] - **I**nterval print ON/OFF
[S] - Rx **S**peaker ON/OFF
[B] - **B**uzzer ON/OFF
[L] - **L**anguage change
[M] - **M**ux ON/OFF } 2852(S) & 2853(S) Option 14 &
[D] - **D**emux ON/OFF } 2854S & 2855S

Confirmation of action is indicated by temporary bottom line message.

Connector panel features

Refer to Fig. 3-2

1 FUSES:

AC mains input fuses:-

Metal case instruments T630mAL250V for 210 V~ to 240 V~ supply or
T1AL250V for 105 V~ to 120 V~ supply.

Plastic case instruments T250mAL250V for 210 V~ to 240 V~ supply or
T400mAL250V for 105 V~ to 120 V~ supply.

Note

Metal case versions have two fuses.
Plastic case versions have one fuse.

2 MAINS INPUT CONNECTOR:

Accommodates the AC supply lead 3 pin connector.

3 VOLTAGE SELECTOR SWITCH:

Selects either 210 V to 240 V or 105 V to 120 V range to suit the local mains AC voltage supply.

4 Cooling fan

5 DC SUPPLY Option:

3-way D-type connector. Enables instrument operation from an external DC supply in the range ±10 V to ±72 V.
or

V.11 - 2850B and 2851 - Structured Data Option

15 way D-type connector. Enables input and output of V.11 structured data and clock signals. Data signals are balanced unipolar signals using line codes - NRZ or biphase. Refer to Chapter 2 for pin assignments.

6 VF IN:

3.5mm 3 pole jack socket. Accepts a voice frequency signal, 0.3 to 3.4 kHz bandlimited. For insertion as a 64 kbit/s encoded signal into the selected channel of a 2851 generated digital signal or a looped digital signal in drop and insert mode. Applies to 1544/2048 kbit/s systems only. Refer to Chapter 2 for pin assignments.

7 VF OUT:

3.5mm 3 pole jack socket. Outputs a voice frequency signal extracted from the selected channel of an incoming digital signal. Applies to 1544/2048 kbit/s systems only. Refer to Chapter 2 for pin assignments.

8 TRANSMIT-OUT:

BNC connector. Outputs 75 Ω unbalanced digital line signal. When Option 09 or 18 is fitted this connector is a type 1.6/5.6

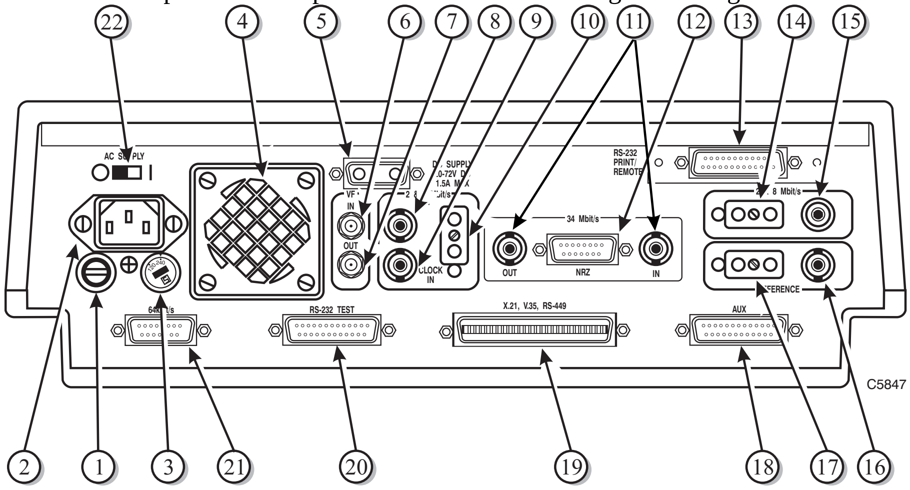
9 TRANSMIT-CLK IN:

BNC connector. Accepts a clock signal from an external source for clocking the 2851 transmitter. When Option 09 is fitted this connector is a type 1.6/5.6

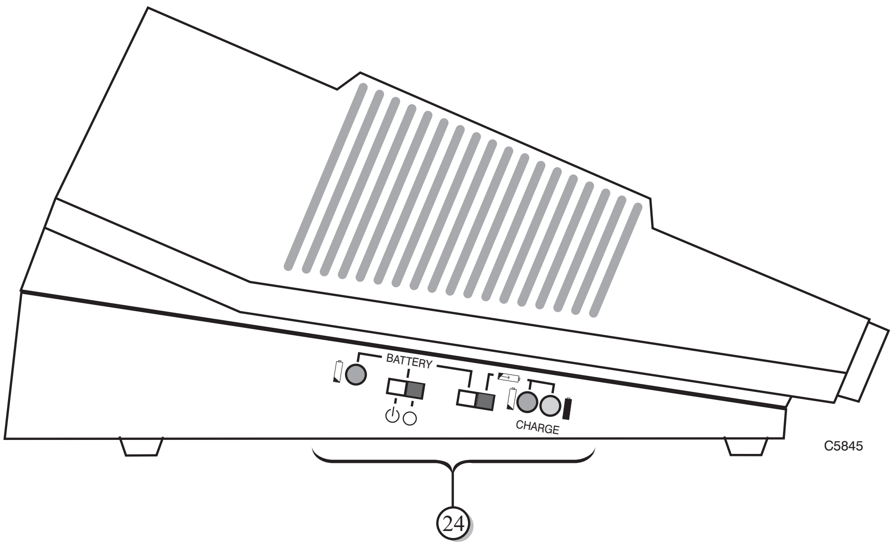
10 TRANSMIT-OUT:

CF connector - Option 01. Outputs 120 Ω balanced digital line signal.

Bantam connector - Option 05. Outputs 100/105 Ω balanced digital line signal.

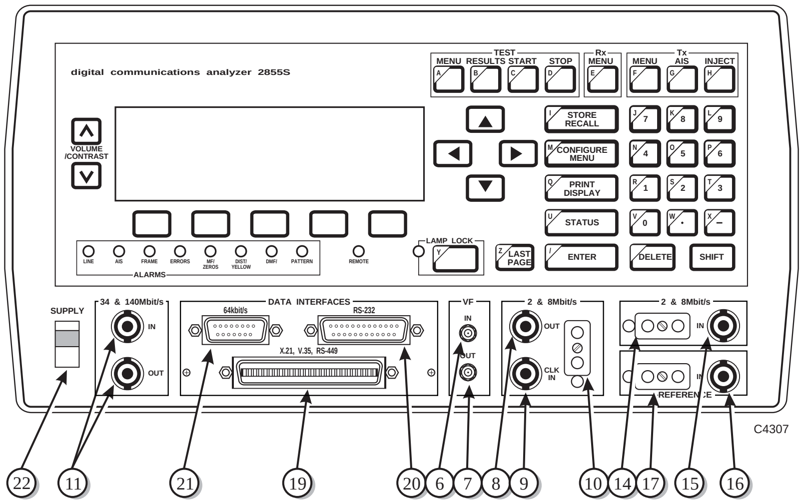


Plastic case - rear view

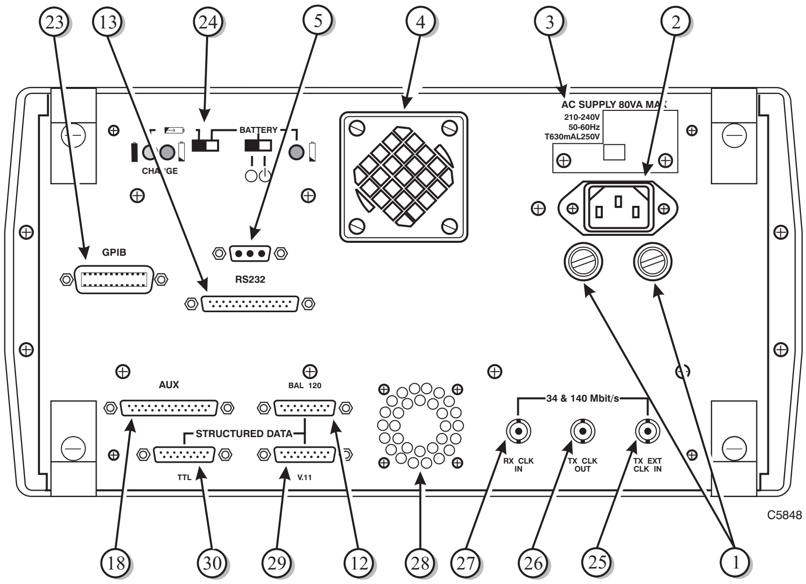


Plastic case - side view
(fitted with battery option)

Fig. 3-2 Connectors



Metal case - front view



Metal case - rear view

Fig. 3-2 Connectors (contd.)

11 34 Mbit/s IN & OUT - 2852(S) &2853(S):

34 & 140 Mbit/s IN & OUT - 2854S &2855S:

Two BNC connectors. Enable input and output of 34 Mbit/s or 140 Mbit/s line code signals. When Option 09 or 18 is fitted these connectors are type 1.6/5.6.

12 34 Mbit/s NRZ - 2852(S) & 2853(S):

15 way D-type connector. Enables input and output of 34 Mbit/s NRZ (unframed) signals. Refer to Chap. 2 for pin assignments.

or

BAL 120 - Structured Data Option:

15 way D-type connector. Enables input and output of balanced 120 Ω structured data and clock signals. Data signals are bipolar signals using line codes : codirectional, contradirectional, AMI 50% or AMI 100%.
Refer to Chap. 2 for pin assignments.

13 RS-232 PRINT/REMOTE:

25 way D-type connector. Enables connection to a printer, printer sharer or a controller/modem for remote control of the 2851. Selection via the Configure-Port page. Can also be used to connect a VDU for an additional/enlarged/remote display. Refer to Chap. 2 for pin assignments.

14 RECEIVE:

CF connector - Option 01, Bantam connector Option 05. Input for a 120 Ω balanced digital line signal**.** If this input is used, disconnect the RECEIVE unbalanced connector, item **15**.

15 RECEIVE:

BNC connector. Input for a 75 Ω unbalanced digital line signal. When option 09 or 18 is fitted this connector is a type 1.6/5.6. If this input is used, disconnect the RECEIVE balanced connector, item **14**.

16 REFERENCE:

BNC connector. Input for a 75 Ω unbalanced reference signal. When Option 09 or 18 is fitted this connector is a type 1.6/5.6. If this input is used, disconnect the REFERENCE balanced connector, item **17**.

17 REFERENCE:

CF connector - Option 01, Bantam connector Option 05. Input for a 120 Ω balanced reference signal. If this input is used, disconnect the REFERENCE unbalanced connector, item **16**.

18 AUX:

25 way D-type connector. Enables auxiliary input and output connections eg. Tx & Rx PRBS sync, NRZ line data, NRZ line clock, NRZ 64 kbit/s data, etc. Refer to Chap. 2 for pin assignments.

19 DATA INTERFACES - 2851(S), 2853(S) & 2855S:

50 way type 57 connector. Enables connections to internal X.21, RS-449 & V.35 circuits by supplied DTE data test interface cable assemblies. Optional cable assemblies provide alternative combinations of V.11, DTE & DCE and V.10, DTE & DCE. Refer to Chap. 2 for details of options and pin assignments.

20 RS-232 TEST - 2851(S), 2853(S) & 2855S:

25 way D-type connector. DTE port for testing RS-232 equipment. Refer to Chap. 2 for details of pin assignments. DCE testing may be performed by using the optional DTE to DCE conversion lead.

21 64 kbit/s ACCESS TEST:

15 way D-type connector. Refer to Chap. 2 for pin assignments.

For PCM: Enables input and output of codirectional or contradirectional encoded 64 kbit/s data for insertion/extraction in the selected channel of the PCM system.

For Data: Enables input and output of codirectional, contradirectional or Eurocom data system signals.

Note **NRZ equivalents are available via the AUX connector, item 18.**

22 SUPPLY:

ON/OFF switch.

23 GPIB Option (metal case versions only):

25 way type 57 connector. Enables connection to a printer or a GPIB controller for remote control. Selection (when fitted) is via the Configure-Port page. Refer to Chap. 2 for pin assignments.

24 Battery Option:

Enables 2851 to operate independent of external supplies. LED's indicate low battery condition and (with mains supply connected and switched to charging operation) fully charged state.

25 TX EXT CLK IN - 2854S & 2855S:

BNC connector. Accepts a sine/square wave (ECL/TTL compatible) signal for use as unframed clock or highest level mux clock. When Option 09 or 18 is fitted this connector is a type 1.6/5.6.

26 TX CLK OUT - 2854S & 2855S:

BNC connector. Outputs an NRZ clock signal at TTL level (up to 50 Mbit/s) or ECL level. When Option 09 or 18 is fitted this connector is a type 1.6/5.6.

27 RX CLK IN - 2854S & 2855S:

BNC connector. Accepts an NRZ clock signal at TTL level (up to 50 Mbit/s) or ECL level to synchronize the incoming receiver signal. When Option 09 or 18 is fitted this connector is a type 1.6/5.6.

28 Cooling fan - 2854S & 2855S:

29 V.11 - 2850BS & 2851S - Structured Data Option :

15 way D-type connector. Enables input and output of V.11 structured data and clock signals.
Data signals are balanced unipolar signals using line codes - NRZ or biphase.
Refer to Chap. 2 for pin assignments.

30 TTL - 2850BS & 2851S Structured Data Option :

15 way D-type connector. Enables input and output of TTL structured data and clock signals. Data signals are TTL binary unbalanced unipolar signals using line codes - NRZ or biphase. Refer to Chap. 2 for pin assignments.

Switching on

Before connecting 2851 to the AC supply (use supplied AC mains lead) check that the setting of the voltage selector switch (rear panel) is compatible with the supply available.

The instrument is normally despatched set to 210 V/240 V range (Option 01) or 105/120 V range (Option 05). See Chap. 2 for details of alternative voltage range and fuses.

Switch power on.

The 2851 carries out a self-test routine indicated by SELFTEST displayed at top left of screen.

If the self-test passes, the Power Up page is displayed (see below).

If the self-test fails, the Selftest Status page is displayed (see following section) and certain default conditions are set (see Appendix A).

Power-up page

```
POWER UP
                     IFR
     DIGITAL COMMUNICATIONS ANALYZER
                XXXX & XXXXS

Software : XXXXX-XXX        Issue : XXX

VERSION
```

This displays the instrument version eg. 2851 & 2851S, the issue of software fitted and allows you to select the Version page by pressing the *[VERSION]* soft key:-

```
CONFIGURE VERSION
Receiver Card   : AD11/01   RAM   : 512k
Software        : XXXXX-XXX Issue : XX.XX
GPIB Card       : FITTED
Option Card     : 140M FRAMED
Option Software : XXXXX-XXX Issue : XX.XX

  NEXT
```

The items displayed are the software version and the hardware options that are fitted.

Pressing the *[NEXT]* soft key displays a second page with more software details.

Any page can now be displayed, refer to "Displaying a menu page".

Selftest Status page

```
SELFTEST STATUS
Battery                          : PASS
Configuration RAM                : FAIL
Stored Results                   : PASS
Configuration Stores             : PASS
AE1 Interface                    : PASS
SDATA Interface                  : PASS

VERSION
```

The Selftest Status page is only displayed if the self-test failed on power-up.

The Selftest Status page indicates the reason for the fail:-

Battery : FAIL

Indicates the non-volatile memory battery supply is below the acceptable minimum voltage. This clears all stored test results, all non-volatile user stores, resets all Tx and Rx conditions and Port assignments to the default settings listed in Appendix A and resets real time clock to 00:00:00 92-JAN-1. To replace the lithium battery refer to the Service Manual.

Configuration RAM : FAIL

Indicates the non-volatile RAM into which all Tx, Rx conditions and Port assignments are stored before power-down is corrupted. This clears all stored test results, all eleven non-volatile user stores and resets all Tx and Rx conditions and Port assignments to the default settings listed in Appendix A. To replace RAM on board AA2, refer to the Service Manual.

Stored Results : FAIL

Indicates the non-volatile memory into which all test results are stored before power-down is corrupted. This clears all the stored test results only. To replace RAM on board AA2, refer to the Service Manual.

Configuration Stores : FAIL

Indicates the 18 non-volatile user stores are corrupted. This labels all the 18 user stores as <corrupted>. To replace RAM on board AA2, refer to the Service Manual.

AE1 Interface : FAIL

Indicates the dual port RAM on board AE1 has failed a standard RAM test. Part of the test involves communication with board AE1. The fault could be due to a faulty RAM, decoding logic, board interconnections or a fault on board AE1. To replace the RAM refer to the Service Manual.

The message *Checksums failed defaults re-loaded* may also be briefly displayed on the bottom line of the Selftest Status page. This indicates checksum tests carried out in self-test have failed and the default instrument settings have been set. (See Appendix A).

Structured Data Interface : FAIL

Indicates board AH1 has failed the power-up self-test. This does not affect the configuration of the rest of the instrument.

Auto Restart page

If power-down occurred during a test the Auto-restart page is displayed at power-up:-

```
AUTO RESTART

TEST RESTARTED FOLLOWING POWER RECOVERY

Power Failed     : 95-Apr-10  06:10:23
Power Recovery   : 95-Apr-10  09:13:27


VERSION
```

The Version page can be selected from this page.

Selectable page types

Refer to Fig. 3-3

Menu pages

Menu pages list the edit and status pages which can be selected from that menu. A menu is selected by pressing a front panel menu key.

TX and Rx Mode of operation

For Tx and Rx menu pages a further soft key menu is available to change the mode of operation if required.

Edit pages

Edit pages allow you to configure the 2851 to the selected system and to define the test requirements and other instrument functions.

Status pages

Status pages show instrument settings and test progress/results only. They do not contain parameters which can be edited.

Note **The parameters and soft key options shown in a display page depend on the selected system and parameters selected in other pages.**

Note **Some of the display page examples that follow show selections that are not possible in that combination but they are listed to show what and where they are available.**

Displaying a menu page

CONFIGURE-MENU, TEST-MENU and RESULTS-MENU.

Pressing one of these dedicated keys displays the corresponding menu page.

TX-MENU and RX-MENU.

Pressing [TX MENU] key or [RX MENU] key displays a page showing the menu selections for a particular mode of operation as indicated on the top line. The page displayed will be for the mode last selected.

If this mode is not the one required, pressing soft key *[MODE]* at the bottom of the page will

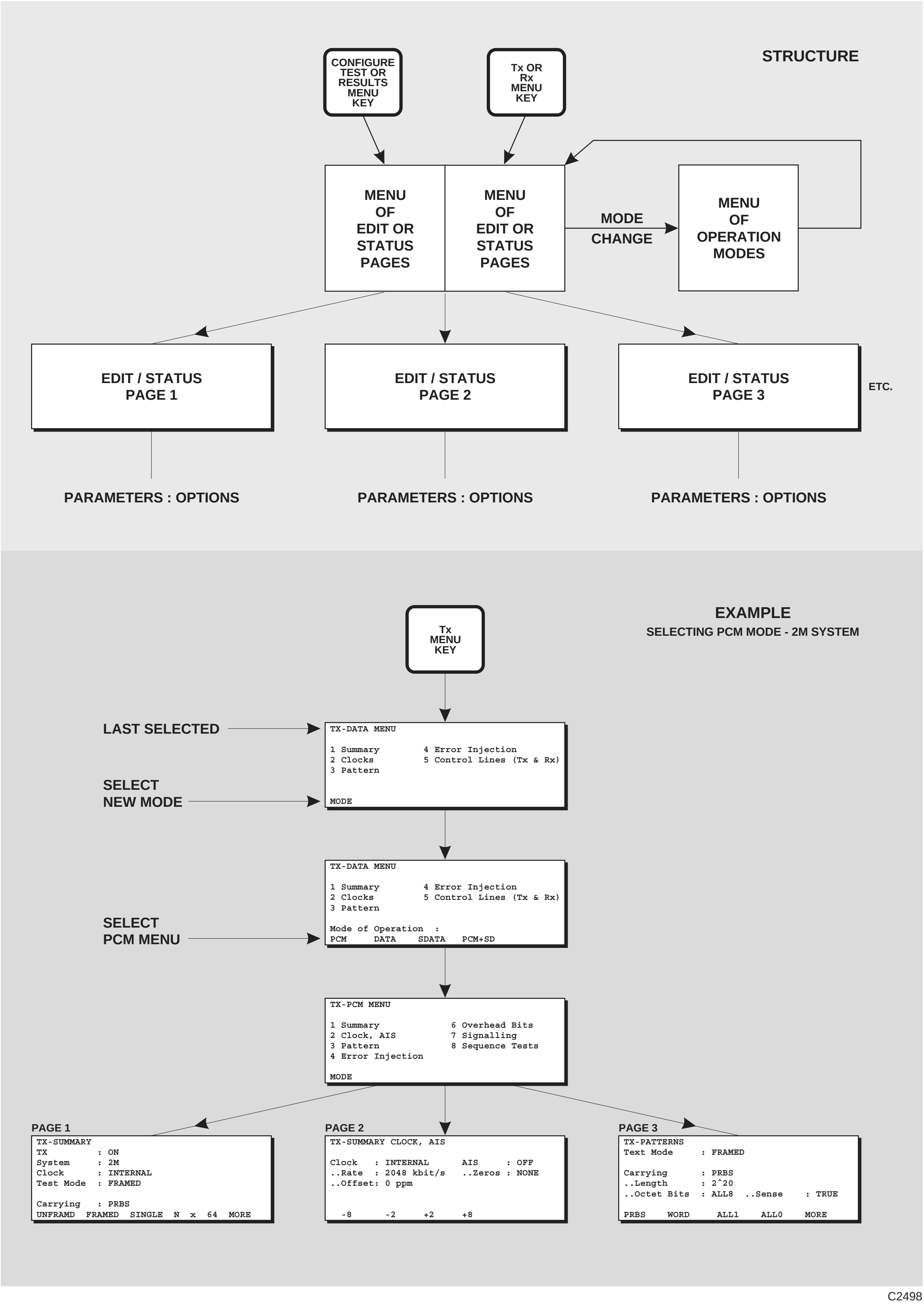


Fig. 3-3 Page selection structure with typical examples

reveal all the modes of operation available for selection. Selecting another mode will display the menu page for that mode.

Example - Selection of TX-MENU (Last selected Tx mode was DATA)

Press [TX MENU] key

```
TX-PCM MENU

1 Summary              4 Error Injection
2 Clocks               5 Control Lines (Tx&Rx)
3 Pattern



 MODE
```

To change the mode:

Press *[MODE]*

```
TX-DATA MENU

1 Summary              4 Error Injection
2 Clocks               5 Control Lines (Tx&Rx)
3 Pattern

Mode of Operation :
  PCM     DATA    SDATA   PCM+SD
```

Press the soft key for the new mode required.
For example press *[PCM]*.

```
TX-PCM MENU

1 Summary              6 Overhead Bits
2 Clocks               7 Signalling
3 Pattern              8 Sequence tests
4 Error Injection

 MODE
```

Moving to an edit/status page

To select from the menu:

Press the number key corresponding with the page number in the menu and the display will change to the selected page.

or

Highlight the selection required by pressing the up/down arrow keys and then press [ENTER] to display the selected page.

For example:

To select PATTERN page from the TX-PCM MENU shown below:

```
TX-PCM MENU

1 Summary            6 Overhead Bits
2 Clock, AIS         7 Signalling
3 Pattern            8 Sequence tests
4 Error Injection

 MODE
```

Press key number 3 or use arrow keys to highlight Pattern and press [ENTER]

```
TX-PATTERN
Test Mode         : FRAMED SINGLE CHANNEL
..Channel         : 8
Carrying          : EXTERNAL DATA
..Data Code       : DSO - BIPOLAR NRZ

Fill Pattern      : PRBS 2^15
 UNFRAMD  FRAMED  SINGLE  NX64
```

The TX-PATTERN page is an edit page which lists the Tx pattern parameters e.g. "Test Mode" and "Channel" and their currently selected options e.g. "FRAMED SINGLE CHANNEL" and "8".

The first parameter in an edit page which can be edited is always highlighted e.g. "FRAMED SINGLE CHANNEL" in the example above.

Move to another page

After moving from the menu to a page, move to another page belonging to the same menu by pressing [LAST PAGE] to display the menu page and select another page. Move to another page belonging to another menu by pressing the appropriate menu key and select the required page.

You can move back contiguously through the last ten page movements including other menus by pressing [LAST PAGE]. Each previous page is displayed per key press.

Editing procedures

The user can change instrument settings as required by selecting parameters and editing options and values listed in the edit pages. At power-up, the parameter options and values displayed are unchanged from what they were before power-down.

Select an option you wish to change using the up/down or left/right arrow keys. Changes to some options are inhibited because of prevailing operating conditions, e.g. a test is still in progress. A message explaining why the option is not available is displayed on the bottom line. In this condition the options field is still highlighted but no choices displayed.

An option can be changed either by replacing it with a new option, or editing the existing option as applicable. An option can be replaced either by selecting another option above a soft key or entering a new alpha or numeric value using the keypad.

A message can appear on the bottom line of a page. A bottom line message indicates a condition in response to a disallowed keyboard entry e.g. *Invalid Syntax or Value out of range* (See Appendix B).

Autoskip function

This is a function that changes the movement of the highlight cursor following a selection. The function is enabled/disabled on the CONFIGURE-OPTIONS page.

With Autoskip enabled, when an option/value is entered the highlight automatically moves to the next option in the page which can be changed.
With the Autoskip function disabled **you** must select the next option to change.

The following descriptions are written assuming that Autoskip is disabled. Note that Disabled is the power-up condition.

Replacing an option

Where applicable a highlighted option in an edit page can be changed by selecting a new option from those listed in a row at the bottom of the page e.g. PRBS, WORD, VOICE, DATA. Up to 5 options can be displayed on the page at a time. If more options are available, MORE is displayed as the 5th option.

```
TX-PATTERN
Test Mode     : FRAMED SINGLE CHANNEL
..Channel     : 8
Carrying      : EXTERNAL DATA
..Data Code   : DSO-BIPOLAR NRZ

Fill Pattern  : PRBS 2^15
 PRBS    WORD    VOICE    DATA    MORE
```

Display more options by pressing *[MORE]* :-

```
TX-PATTERN
Test Mode     : FRAMED SINGLE CHANNEL
..Channel     : 8
Carrying      : EXTERNAL DATA
..Data Code   : DSO-BIPOLAR NRZ

Fill Pattern  : PRBS 2^15
 ALL 1   ALL 0   ALT 1/0   1 KHz   MORE
```

Select an option by pressing the appropriate soft key e.g. *[ALT 1/0]* :-

Note

In some cases, re-selecting the same softkey option (e.g. Tx or Rx system) forces some default conditions to be set. This may change user options made previously. See Appendix A for default settings.

```
TX-PATTERN
Test Mode     : FRAMED SINGLE CHANNEL
..Channel     : 8
Carrying      : ALTERNATING


Fill Pattern  : PRBS 2^15
 ALL 1   ALL 0   ALT 1/0   1 KHz   MORE
```

ALTERNATING (the long text equivalent of ALT1/0) now replaces the previously displayed option which was EXTERNAL DATA.

Note that the data code parameter and codirectional option are no longer displayed because channel 8 is now set to carry an alternating 1010 test pattern instead of data.

New value entries

Some parameters have values which are changed by typing the new value and pressing [ENTER].

When a new value is required, the prompt:- *New Value*, is displayed at the bottom of the page.

Only the relevant entry keys are enabled.

Note

When *New Value* prompt is present, single key functions will be inoperative as the keys will be interpreted as alphanumeric keys instead.

New value entries prior to pressing [ENTER] can be deleted one character per key press.

Numeric entries

If values entered are out of range, a bottom line message is displayed:- *Value set to minimum limit* or *Value set to maximum limit*. The value will be set to the minimum or maximum limit as appropriate.

To enter a new channel number:-

Highlight the existing channel number e.g. 8.

```
TX-PATTERN
Test Mode    : FRAMED SINGLE CHANNEL
..Channel    : 8
Carrying     : ALTERNATING


Fill Pattern : PRBS 2^15
New Value>
```

Type the new value e.g. 12 using the numerical keys and press [ENTER] to enter the new value.

```
TX-PATTERN
Test Mode    : FRAMED SINGLE CHANNEL
..Channel    : 12
Carrying     : ALTERNATING


Fill Pattern : PRBS 2^15
New Value>
```

12, now replaces the originally displayed value.

Time entries
(eg. on CONFIGURE-TIME/DATE page)

To enter 21:32:05 (32 minutes and 5 seconds past 9 P.M.)

Highlight the Time entry
Type '**21**'
Type '**.**' (displayed as '**:**')
Type '**32**'
Type '**.**' (displayed as '**:**')

Type '**5**' or '**05**'
Press [ENTER]

Note **If the entered value is invalid or out of range, *Invalid Syntax or Value out of range* is displayed briefly on the bottom line and the time is unchanged.**

Date entries
(eg. on CONFIGURE-TIME/DATE page)

To enter 95-03-27 (27th, March, 1995):-

Highlight the Date entry
Type '**95**'
Type '**-**'
Type '3' or '**03**'
Type '**-**'
Type '**27**'
Press[ENTER]

Note **If the entered value is invalid or out of range, *Invalid Syntax or Value out of range* is displayed briefly on the bottom line and the date is unchanged.**

Exponent entries
(eg. TX-ERROR INJECTION page, Mode : RATE)

Integer and exponent values are used to express error rate.

To enter 1×10^{-6} (displayed as 1E-6):-

Highlight the Rate entry
Type '**1**'
Type '**-**' displays 'E-'
Type '**6**'
Press [ENTER] key

Note **If the entered value is invalid, the message *Invalid Syntax or Value out of range* is displayed briefly on the bottom line.**

If the entered value is out of range, *Value set to minimum limit or Value set to maximum limit* is displayed briefly on the bottom line and the value is set to minimum or maximum as appropriate.

String entries
(eg. CONFIGURE-PRINTER page)

The print-out Label and Store names can be entered with any of the characters available on the 2851 keypad. Up to 12 characters can be entered.

Alpha characters are entered by pressing [SHIFT] then the alpha character key.

Type the character string then press [ENTER].

Editing existing options

Binary words

Some parameter values use binary words which can be changed by editing digits in the word.

To change Tx word pattern:-

Highlight the existing word value e.g. 01010101 01010101

```
TX-PATTERN
Test Mode     : FRAMED

Carrying      : 16 BIT WORD
..Word Value  : 01010101 01010101


     0        1       LEFT     RIGHT    ENTER
```

Move the cursor over the bit to be changed by pressing the *[RIGHT]* or *[LEFT]* soft keys. The cursor moves one bit per key press and flashes that bit.

Change the flashing bit by pressing the 0 or 1 soft keys as required. The cursor moves one bit to the right after a change. Press [ENTER] to set the word you have just edited as the new value.

Increment/Decrement numeric values

The numerical values for Tx clock rate and clock offset are changed by incrementing or decrementing the value in fixed steps by pressing the appropriate soft key.

Clock rate is incremented/decremented in 2 kHz or 8 kHz steps below 3 Mbit/s and 8 kHz steps above 3 Mbit/s.

Clock offset is incremented/decremented in 25 ppm steps below 34 Mbit/s or 5 ppm steps for 34 Mbit/s. In both cases if the maximum or minimum values are exceeded, a bottom line message *Value set to maximum limit* or *Value set to minimum limit* is displayed.

Store/recall

Pressing [STORE/RECALL] key displays a menu page allowing access to four different types of stores as shown below.

```
STORE/RECALL

1.  User Configs
2. Fixed Configs
3. Tests
4. Autoprints
```

User Configs and **Fixed Configs** stores are for the storage of instrument configurations.

Tests store is for the storage of test results.

Autoprints store is for the storage of autoprint event/interval results.

User Configs and Fixed Configs

Introduction

All 2851 instrument settings displayed in their edit pages prior to power down are automatically stored in the non-volatile memory. At switch-on, these same settings will be displayed unchanged.

Up to 18 other sets of instrument settings, selected by the user, can also be stored in the non-volatile User Config store so that a particular set of instrument settings can be conveniently recalled.

A second non-volatile Fixed Config store contains sets of typical common instrument configuration settings available for recall. These are factory programmed and cannot be deleted or written to be the user. The DEFAULT set contains all the instrument default settings as defined by Aeroflex. Refer to Appendix A for details of the configurations and defaults.

Store current instrument settings (User configs)

Press [STORE/RECALL]

Press [1] or highlight the line - User Configs and press [ENTER].

```
STORE/RECALL-USER CONFIG
<empty>        <empty>        2MCRC
<empty>        <empty>        <empty>
<empty>        TEST C         <empty>
TEST A         X.21           T1ESF
TEST B         <empty>        <empty>
<empty>        <empty>        <empty>
 STORE
```

The STORE/RECALL-USER CONFIG display shows 18 user stores.

The example above shows 12 empty stores and 6 full stores.

Highlight an empty store and press *[STORE]* soft key.

```
STORE/RECALL-USER CONFIG
<empty>        <empty>        2MCRC
<empty>        <empty>        <empty>
<empty>        TEST C         <empty>
TEST A         X.21           T1ESF
TEST B         <empty>        <empty>
Store name:
New value >
```

Enter a name for you to identify the current instrument settings in the future (up to 12 alpha numeric characters can be entered) e.g. TRIAL TEST 25.

Press [ENTER]:-

```
STORE/RECALL-USER CONFIG
TRIALTEST 25   <empty>        2MCRC
<empty>        <empty>        <empty>
<empty>        TEST C         <empty>
TEST A         X.21           T1ESF
TEST B         <empty>        <empty>
<empty>        <empty>        <empty>
 DELETE   RECALL
```

The current instrument settings with the label TRIALTEST 25 are now stored. If Autoskip is enabled the next full or empty store on the page is highlighted.

Instrument settings cannot be stored while a test is running.

Delete a store (User configs only)

Highlight the store name and press *[DELETE]*. Select confirm option and the selected store is deleted and replaced by <empty>. If Autoskip option is enabled, the next store - full or empty is highlighted. Note that a store can be deleted while a test is running.

Recall a store

Highlight the store to be recalled on USER CONFIG page or FIXED CONFIG page.

Press the *[RECALL]* soft key. The bottom line message *Recalling Configuration* is displayed while the stored contents are being recalled. If Autoskip is enabled, the next full or empty store is highlighted.

A store cannot be recalled while a test is running.

Tests

Introduction

Up to 6 complete sets of test results can be stored in files and recalled for later examination. The recalled file becomes the displayed set of results as shown on the TEST-RESULTS pages.

After a test has run and stopped, a top line message *TEST STORE* is displayed on all pages. This indicates that the test results are ready to be stored. The message is displayed until:

1. a new test is started (current test results are cleared to receive new measurements),
2. the test results are stored in a file or
3. a stored file is recalled (this overwrites the test results as displayed on the TEST-RESULTS pages).

Store a test result

Press [STORE/RECALL]
Highlight the line - Tests and press [ENTER].

```
STORE/RECALL-TESTS                 TEST STORE
*<test results>      95-APR-27  22:46:03
TEST NUMBER ONE      95-APR-27  22:33:21
TEST A               95-APR-27  22:36:18
TEST B               95-APR-27  22:41:42
TEST C               95-APR-27  22:44:10

 STORE
```

A list of test files is displayed with name, date and time as shown above. The date and time is the start time and date of the test as would be displayed on the TEST-PROGRESS page.

The first entry is always <test results> which represents the set of results displayed on the RESULTS pages. A symbol * displayed before <test results> only (as shown in example above), indicates this is the latest set of test results that have not been stored.

Scroll up and down the list using the arrow keys.

Highlight *<test results>, press *[STORE]* and enter a name of up to 12 alpha/numeric characters. Select confirm option and the current test results are filed under that name and *TEST STORE* message is removed. A symbol * is displayed before the file name to indicate that this store is now represented by <test results>.

A symbol * displayed before the <test results> entry and a file name indicates that the latest set of test results have been stored in that file. The symbol before the file name is removed when a new test is started. The symbol before <TEST RESULTS> is removed when another test is recalled.

A warning message is displayed if 6 tests have already been stored. If a test is running, STORE *not allowed if test in progress* message is displayed.

Delete a stored test result

Highlight the file name and press *[DELETE]*. Select confirm option and the test file and entry line is deleted. A file can still be deleted if a test is running.

Recalling a stored test result

Highlight the file name and press *[RECALL]*. A symbol * is displayed against the recalled file name. The recalled test results replace the previous set and are now available for viewing on the TEST-RESULTS pages. The message *RECALLED TEST* is displayed on all pages to indicate the status.

Note that a test result file cannot be recalled if a test is running.

Autoprints

Introduction

Autoprint function is the automatic printing of test results for events and intervals but can be configured so that autoprint text is sent to RAM instead of directly to a printer.

Autoprint to Printer or to RAM is set on the CONFIGURE-PRINTER page. On completion of the test when set to RAM, the autoprint text is retained in RAM. This can then be permanently stored in a named file for viewing or printing as selected on the STORE/RECALL-Autoprints pages.

A top line message *PRINT STORE* is displayed on <u>all pages</u> to indicate that this option is now available. The message is displayed until:

1. A new test is started (in which case print RAM is cleared to receive new printouts) or
2. The autoprint text in RAM is stored in a print file.

Autoprint text can be stored in up to 20 print files with maximum of 10,000 print lines overall, each print line 40 characters long.

Note that Print to RAM applies only to autoprint operation and has no connection with front panel [PRINT DISPLAY] key.

To clear RAM completely (for example if memory is corrupted) hold down the end soft key on the right while powering up the instrument.

Configure autoprint to RAM

On the CONFIGURE-EVENT PRINT or/and CONFIGURE-INTERVAL PRINT page complete the selections for the test parameters and on the CONFIGURE-PRINTER page set Print To : RAM.
See following CONFIGURE section for Event and Interval parameter selection details.

After the test has run and stopped, autoprint text is retained in RAM for viewing or printing and message *PRINT STORE* is displayed.

Store an autoprint text file

When *PRINT STORE* message is displayed,

Press [STORE/RECALL].
Highlight the line - Autoprints and press [ENTER].

```
STORE/RECALL-PRINT RAM        PRINT STORE
<texts>         15    95-APR-23  28:08:03
TEST 1          102   95-APR-23  21:33:21
TEST            7198  95-APR-23  22:36:18
123456789012    2     95-APR-23  24:41:42
TEST 2          25    95-APR-23  26:08:03

 STORE    VIEW
```

A list of previously stored print files is displayed with name, number of lines of text, date and time as shown in example above. The date and time is the start time and date of the test as displayed on the TEST PROGRESS page.

The first entry on the page is always <texts>.

Scroll up and down the list using the arrow keys.

Highlight <texts>, press *[STORE]* and enter a name of up to 12 alpha/numeric characters. Select confirm option and the autoprint text is stored under the entered file name and the *PRINT STORE* message is removed. Print lines entry for <texts> returns to 0.

A symbol * displayed before the filename, indicates this is the latest autoprint text that has been stored.

A warning message - *Print RAM full* is displayed if the print RAM is full or very nearly full.

Delete a stored print file

Highlight the file name and press *[DELETE]*. Select confirm option and the entry line is deleted.

View a stored print file

Highlight the print file name and press *[VIEW]*.

```
95-07-07 12:34:00  START OF TEST      01
IFR2851 ID : 01     LABEL : DEMO PRINT
Test Mode  : INDEF Major Error : PATTERN
++ RX SETUP ++       ++ TX SETUP ++
System     : 2M/CRC  System    : 2M/CRC
Line code  : HDB3    Line code : HDB3
 STATS    MARK    PRINT  MOVE TO  LINE
```

Six lines of the print file are displayed as shown in example above.

Scroll up and down the file one line at a time using the up/down arrow keys or one page, ie. 6 lines, at a time using the left/right arrow keys.

[STATS]

Pressing the *[STATS]* soft key displays a page showing information about the file being viewed, see example below.

```
VIEW PRINT FILE
Test1                    Files      :  1
94-Jul-21 13:15:29    Free Lines :  5807
At Line   :  0
[...      :  0
    ...]  :  1
Length    :  21
  VIEW
```

TEST1	=	Name of selected print file on view page
Files	=	Total number of stored print files
Free Lines	=	Unused lines available
At Line	=	Number of line at top of print file view page
[...	=	Line number at start of marked block of text
...]	=	Line number at end of marked block of text
Length	=	Number of lines in selected print file

Pressing *[VIEW]* returns the display to the selected print file view page.

[MARK]

Pressing the *[MARK]* soft key enables further soft key options allowing a block of text to be marked for printing instead of whole file or previous markings to be cleared. The options are - *[* ***[...*** *]*, *[* ***...]*** *]* and *[CLEAR]*.

Select start of block and press *soft key [* ***[...*** *]*. Select end of block and press *soft key [* ***...]*** *]*. These symbols appear on the display to mark the start and end of the block.

Press *[CLEAR]* to remove the block marks.

[MOVE TO]

Pressing the *[MOVE TO]* soft key enables further soft key options allowing rapid movement within the print file. The options are - *[START]*, *[END]*, *[* ***[...*** *]* and *[* ***...]*** *]*.

Press *[START]* or *[END]* to move to start or end of file.

Press *[* ***[...*** *] or [* ***...]*** *]* to move to start or end of marked text.

[LINE]

Pressing *[LINE]* enables movement to a selected line.

Enter the line number following the prompt and press [ENTER].

[PRINT]

Pressing the *[PRINT]* soft key enables further soft key options allowing a marked block of text or the entire print file to be printed. The options are - *[* ***[...]*** *], [FILE] and [CANCEL]*.

Press *[* ***[...]*** *]* to print the previously marked section or press *[FILE]* to print the entire file.

Press *[CANCEL]* to abort printing.

Starting a test

Before starting a test, check the physical connections between the 2851 and the PCM or data or structured data system are correct. Check that the correct mode of operation for the transmitter and receiver has been selected, that the correct system has been selected and that the parameters and options for the system and test are correctly set up in the Tx, Rx, Configure and Test pages.

Start test

When you are satisfied all conditions are correct, (usually by ensuring no LED's are on), you may start a test by pressing the [START] key in any page. *TEST RUNNING* is displayed top right of the current page. All results in non-volatile memory are cleared when the [START] key is pressed.

Results

Results are accumulated in the Results pages. Monitor the received test pattern, overhead bits, signalling codes and dialling errors in the Receiver pages. The RESULTS-SYNC STATUS page indicates if signal is present and if frame, pattern or CRC are synchronized.

Test progress

If the 2851 is left unattended for long periods, a summary of test progress can be monitored in the TEST-PROGRESS page which displays test start and stop times, length of measurement and - if it occurred - the recorded total time power was lost during the test.

Stop test

The test can be stopped at any time by pressing the [STOP] key.

Test store

When the test has stopped the message *TEST STORE* is displayed top right on all pages. This indicates that now is the time to store the current test results before they are cleared at the start of the next test.

To store the results press [STORE/RECALL] key and proceed as described in previous section headed "*Store a test result*" on page 3-25. If storage is not required ignore the message and it will be removed at the start of the next test, or if a previously stored test is recalled.

Print store

If 2851 has been configured for Autoprint to RAM the message *PRINT STORE* is displayed top right on all pages when the test has stopped. This indicates that now is the time to store the autoprint text retained in RAM before the text is cleared at the start of the next test.

To store the autoprint text press [STORE/RECALL] key and proceed as described in previous section headed "Store an autoprint text file" on page 3-27. If storage is not required ignore the message and it will be removed at the start of the next test.

Keyboard lock

The keyboard can be locked to prevent unauthorized local operation particularly during an unattended test. Lock or unlock the keyboard by pressing [SHIFT] plus a soft key. When the keyboard is locked the top line message *KEYBD LOCKED* is displayed.

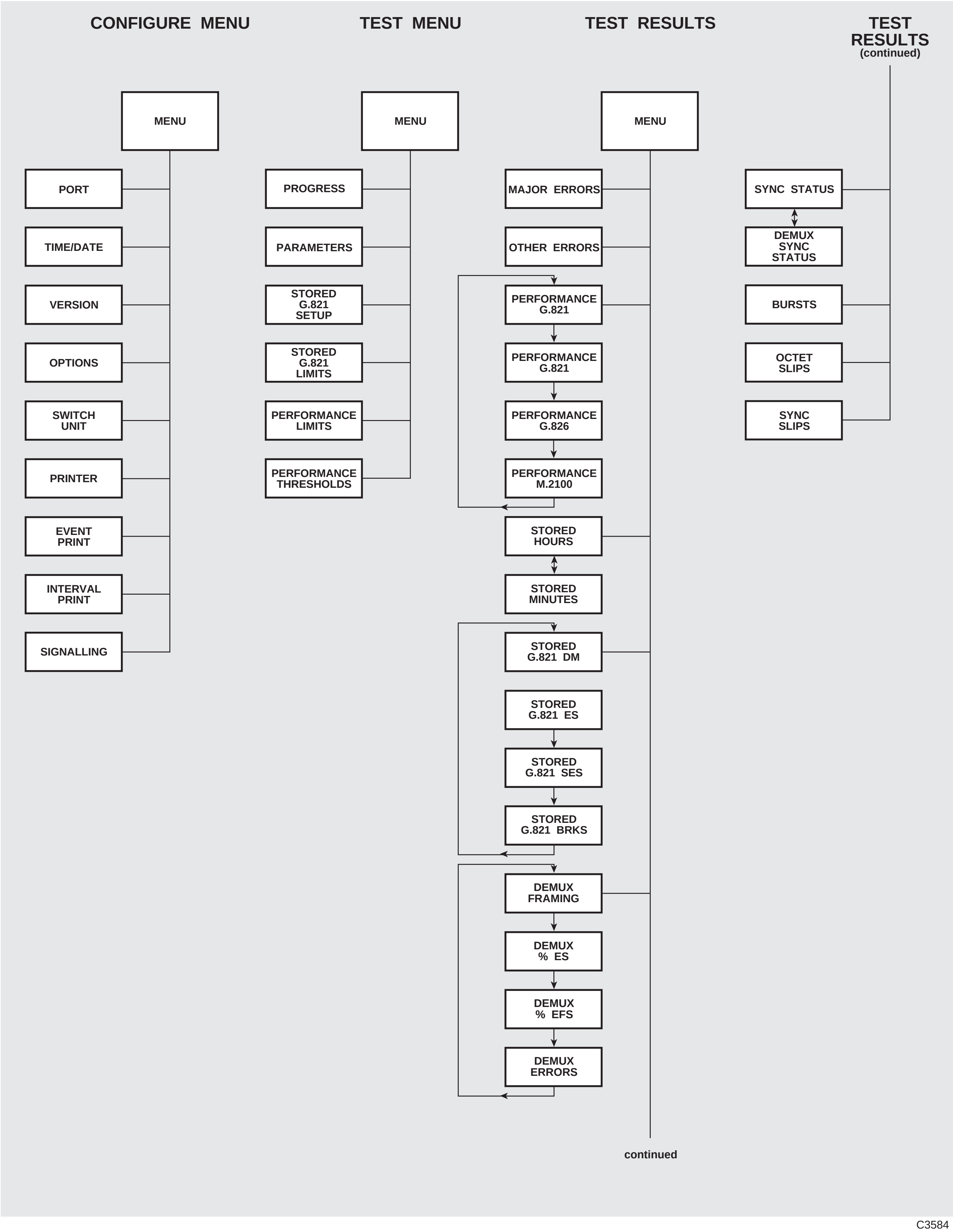
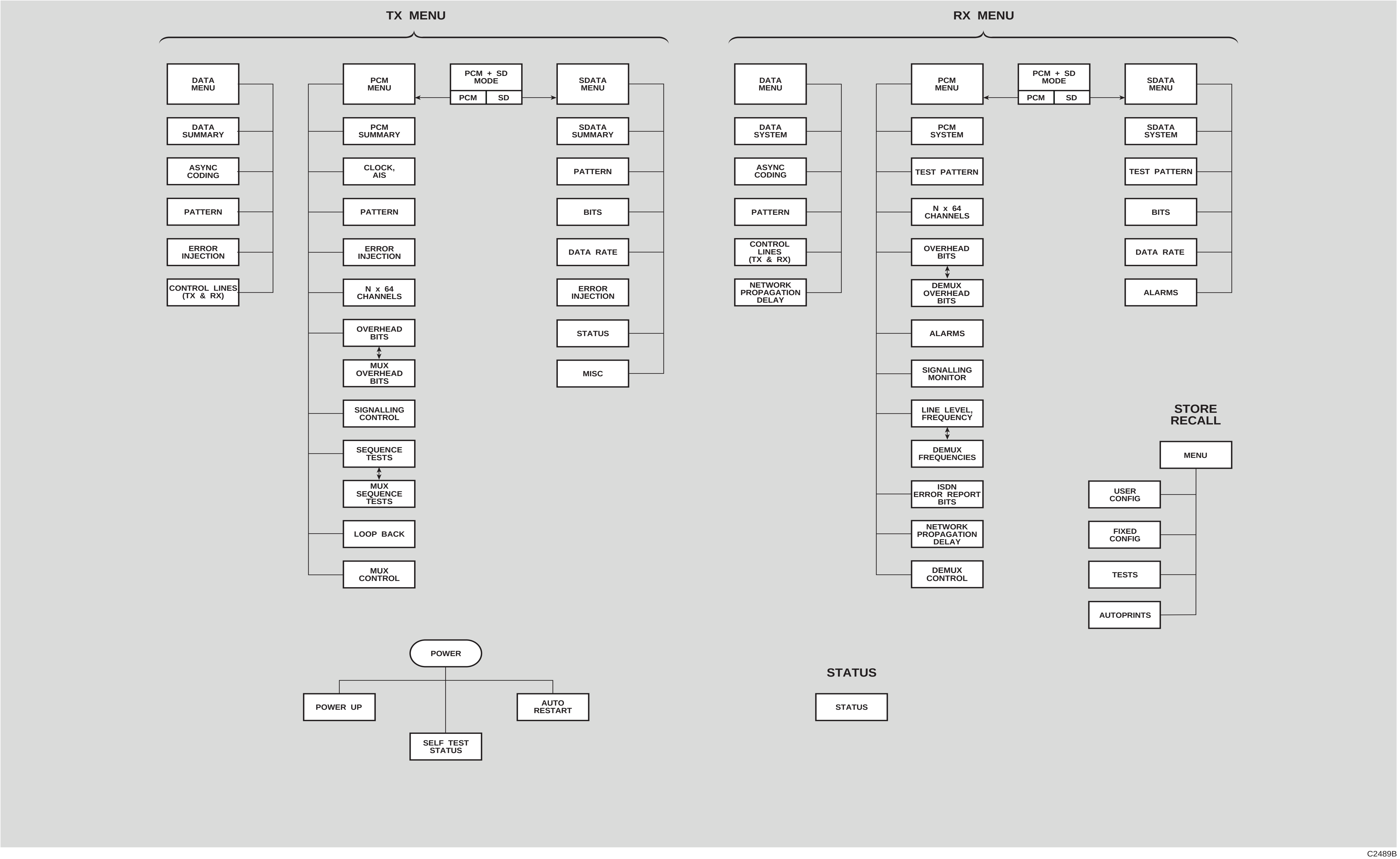


Fig. 3-4 Location of selectable pages



Note...

Some pages shown depend on the selected system and parameters selected in other pages.

Fig. 3-4 Location of selectable pages (Contd.)

CONFIGURE MENU

```
CONFIGURE-MENU

1 Ports            6 Printer
2 Time / Date      7 Event Print
3 Version          8 Interval Print
4 Options          9 Signalling
5 Switch Unit
```

```
CONFIGURE-PORT
------ RS-232 ------ ------ GPIB ------
Used For  : PRINTER  Used For : REMOTE
Baud Rate : 300
Format    : 7 O 1    Address  : 4

Handshake : HARDWARE AND SOFTWARE
 NONE   REMOTE  PRINTER SHARER  TERMNAL
```

```
CONFIGURE-TIME / DATE

Time   : 13:37:08
Date   : 92-05-05 = 92-May-05


New Value >
```

```
CONFIGURE-VERSION

Receiver Card  : AD11/1
GPIB card      : FITTED
Option card    : 34 M FRAMED
Software       : XXXXX-XXX  Issue : XXX
```

```
CONFIGURE-OPTIONS
Auto-skip Cursor         : DISABLED
Voice Encoding           : A LAW
Language                 : ENGLISH
Errors LED Threshold     : 1E-6
Count CODE Excess Zeros  : DISABLED

 ENGLISH FRENCH ITALIAN SPANISH
```

```
CONFIGURE-SWITCH UNIT

Switch unit        : TYPE 1

Data Port          : X.21 (V.11) DTE
PCM Port           : UNBALANCED

NONE     TYPE 1
```

```
CONFIGURE-PRINTER

Printer Type       : TEXT ONLY
      ..Terminator : CR+LF
Printout ID No.    : 1
      ..Label      : 2851
Print to           : PRINTER

NONE     CR      LF     CR+LF
```

```
CONFIGURE-EVENT PRINT
Event Print : ON
..Alarm Change                 : YES
..Errored Second               : NO
..Signalling/ISDN Change       : YES
..Crossing Threshold..1E-6     : NO
  Performance Limit Exceeded   : NO
  OFF     ON
```

```
CONFIGURE-INTERVAL PRINT
Interval Print : OFF ..Every..15 MINUTES
..Major Errors       : YES
..Other Errors       : YES
..Sync Slips         : NO
..                        G.826 : NO
..Stored Results     : NO G.821 : NO
  OFF     ON
```

```
CONFIGURE-SIGNALLING
Pulse Break Min/Max          : 50  / 100 ms
Inter-Pulse Break Min/Max    : 25  / 50  ms
Inter-Digit Pause Minimum    : 400 ms
Pulse Break Code             : 0011
Inter-Pulse Break Code       : 1011
Dial Mapping                 : 1-9,0
  0-9    1-9,0    9-0    0,9-1
```

Note...

Some parameters and soft key options shown depend on the selected system and parameters selected in other pages.

TX MENU

DATA

```
TX-MENU

1 Summary     4 Error Injection
2 Coding      5 Control Lines (Tx & Rx)
3 Pattern
```

```
TX-SUMMARY                           TX: OFF
TX          : OFF
System      : RS-232 DTE
Test Mode   : ASYNC

Bit Rate    : 9600 kbit/s
Carrying    : PRBS
  PCM   232 DTE  232 DCE  CO-DIR  MORE
```

```
TX-ASYNC CODING

Bit Rate   : 9600 bit/s
Data Bits  : 7
Parity     : ODD
Stop Bits  : 1
Char Rate  : MEDIUM
   5       6       7       8
```

```
TX-PATTERN

Carrying      : PRBS
..Length      : 2^15 ..Sense : INVERT


 PRBS    FOX1    FOX2   FOX3    MORE
```

```
TX-ERROR INJECTION
Injection : ENABLED        Mode : RATE
                           Rate : 1E-6
1st Target Bit : PATTERN
Inject..       : BIT ERRORS


DISABLE  ENABLE
```

```
TX/RX-CONTROL LINES
Tx:                  Rx:
RTS : 1              CTS  : 0
DTR : 1              DSR  : 0
RL  : 0              RLSD : 0
LL  : 0              TM   : 0
Delay : READY             = 0     ms
 STOP   EXECUTE
```

PCM 2M

```
TX-MENU

1 Summary            6 Overhead Bits
2 Clock, AIS         7 Signalling
3 Pattern            8 Sequence Tests
4 Error Injection
5 Nx64 Channels      0 Mux Control
```

```
TX-SUMMARY                            TX: OFF
TX         : OFF                 AIS : OFF
System     : 2M                 Code : HDB3
Clock      : INTERNAL
Test Mode  : FRAMED

Carrying   : PRBS
 DATA     704k    T1SF   T1SFns    MORE
```

```
TX-CLOCK, AIS

Clock    : INTERNAL          AIS    : OFF
..Mode   : Variable        ..ZEROS  : NONE
..Rate   : 2048 kbit/s
..Offset: 0  ppm

INTRNL  EXTRNL  RECEIVR  EXT  TTL
```

```
TX-PATTERN
Test Mode      : FRAMED

Carrying       : PRBS
..Length       : 2^15
..Octet Bits : ALL 8 ..Sense     : INVERT

UNFRAMD FRAMED  SINGLE  N x 64    MORE
```

```
TX-ERROR INJECTION
Injection : ENABLED        Mode : RATE
                           Rate : 1E-6
1st Target Bit : PATTERN
Inject..       : BIPOLAR VIOLATIONS
            .. : SINGLY

  BIT     BPV
```

```
TX-Nx64 CHANNELS

GROUP      1  2  3  4  5  6  7  8  9 10
          11 12 13 14 15 16 17 18 19 20
          21 22 23 24 25 26 27 28 29 30


 SET N  RESET N  CLEAR  Tx->Rx  CURSOR
```

```
TX-OVERHEAD BITS
TS0 : IFFFFFFF INAUUUUU   MF : MMMMPLPP
      10011011 11011111        00001011

N Bit              : 1       I Bits : 11
A Bit (1=Alarm)  : 0       U Bits : 11111
L Bit (1=Alarm)  : 0       P Bits : 111
   0       1
```

```
TX-SIGNALLING CONTROL
Mode               : CHANNEL ASSOCIATED
Active Channel : 1         ABCD     DEC
Code in Active Channel : 0101       5
Code in Other Channels : 0101       5

Dial Number : 0438742200
CHANNEL  DTMF  C_BIT
```

```
TX-SEQUENCE TESTS

Error  1  Frame Words  : READY
Error  1  MF Word      : READY
64kbit/s AIS           : READY
TS 16 to 0             : READY

  ALL      1       2       3       MORE
```

```
TX-MUX CONTROL
Mux : OFF  From: 2M    Clock     : INTERNAL
Code: CMI  ..To: 140M  ..Offset: 0  ppm
                          Output: True
34M Trib            Fill Pattern : All 1
8M Trib   : 1       Fill Pattern : ALL 1
2M Trib   : 1       Fill Pattern : ALL 1
  OFF      ON
```

PCM T1

```
TX-MENU

1 Summary            6 Overhead Bits
2 Clock AIS          7 Signalling
3 Pattern            8 Sequence Tests
4 Error Injection    9 Loopback
```

```
TX-SUMMARY                            TX: OFF
TX          : OFF               AIS : OFF
System      : T1ESF            Code : B8ZS
Clock       : INTERNAL
Test Mode   : FRAMED

Carrying    : QRSS
 DATA     704k    T1SF   T1SFns    MORE
```

```
TX-CLOCK, AIS

Clock    : INTERNAL          AIS    : OFF
..Rate   : 1544 kbit/s     ..Zeros: NONE
..Offset: 0  ppm

Level    : NORMAL-CABLE SIMULATOR OUT
INTRNL  EXTRNL  RECEIVR  EXT TTL
```

```
TX-PATTERN
Test Mode      : FRAMED

Carrying       : QRSS

..Octet Bits : ALL 8

UNFRAMD FRAMED  SINGLE
```

```
TX-ERROR INJECTION
Injection : ENABLED        Mode : RATE
                           Rate : 1E-6
1st Target Bit : PATTERN
Inject..       : BIPOLAR VIOLATIONS
            .. : SINGLY

SINGLY  BURSTS
```

```
TX-OVERHEAD BITS

Data Link : MMMMMMMM  MMMMMMMM
            11111111  11111111

M Bits     : 11111111 11111111

   0       1      LEFT     RIGHT    ENTER
```

```
TX-SIGNALLING CONTROL
Mode               : CHANNEL ASSOCIATED
Active Channel : 1         ABCD
Code in Active Channel : 0101
Code in Other Channels : 0101

Dial Number : 0438742200
CHANNEL  DTMF
```

```
TX-SEQUENCE TESTS

Error  1  Frame Bits          : READY

YELLOW Alarm (BIT 2's to 0)  : OFF

  ALL      1       2       3       MORE
```

```
TX-LOOPBACK
                  Bits Code
Make Code A     : 5   10000
Break Code A    : 3   100
Make Code B     : 4   1100
Break Code B    : 4   1110
Loopback Mode : INACTIVE
New Value >
```

RX MENU

PCM 2M

```
RX-MENU

1 System        6 Signalling Monitor
2 Test Pattern  7 Line Level, Frequency
3 Nx64 Channels 8 ISDN Error Report Bits
4 Overhead Bits 9 Network Prop. Delay
5 Alarms        0 Demux Control
```

```
RX-SYSTEM
Frequency  = 2048000 Hz Offset = -20 ppm
System     : 2M             ALBO : OUT
Input Mode : TERMINATED    Code : HDB3
Test Mode  : FRAMED

 DATA     704k    T1SF   T1SFns    MORE
```

```
RX-TEST PATTERN
Test Mode     : FRAMED

Sync to       : PRBS
..Length      : 2^15
..Octet Bits : ALL 8 ..Sense   : INVERT
Carrying      : 00000000 00000000
 PRBS   REPWORD  LIVE
```

```
RX-Nx64 CHANNELS

CURSOR   1  2  3  4  5  6  7  8  9 10
        11 12 13 14 15 16 17 18 19 20
        21 22 23 24 25 26 27 28 29 30

  SET    RESET   CLEAR  Rx->Tx   GROUP
```

```
RX-OVERHEAD BITS

Frame Word        : 0FFFFFFF

Not Frame Word    : 00A00000

Multiframe Word   : MMMM0A00
```

```
RX-ALARMS
           AIS    FRAME    DIST
140M    :
34M     : <<
8M      :
2M      :
```

```
RX-SIGNALLING MONITOR
Mode     : SINGLE CHANNEL MONITOR
Channel : 1        ABCD     DEC
Present code    :
Previous code   :
Dialled Number : 123x56x8x0
Error Code     :    1  2  3
SINGLE  ALL  DTMF  C_BIT
```

```
RX-LINE LEVEL,FREQUENCY
Frequency  = 2048000 Hz Offset = -20 ppm

RX Input   : BALANCED
Line Level = 0.000  V
           = 0.0  dB relative to 3.000 V

 BAL    UNBAL
```

```
RX-ISDN ERROR REPORT BITS

 1:01010    3:01110    5:00000    7:11011
 9:01010   11:01110   13:01010   15:01110

 CD ->LT   NT1->LT   LT->NT1   NT2->NT1

 S:  0D0   S:  SD0   S:  000   S:  000
```

```
RX-NETWORK PROP. DELAY

Mode  : READY
Delay = 0.000      ms
    ( = 0          bits )


 STOP    EXECUTE
```

```
RX-DEMUX CONTROL
Frequency= 0         Hz   Offset= 0  ppm
Demux     : OFF          From : 140M
34M Trib : 1             ..To : 2M
 8M Trib : 1            Input : BRIDGING
 2M Trib : 1             Code : CMI

  OFF      ON
```

PCM T1

```
RX-MENU

1 System        6 Signalling Monitor
2 Test Pattern  7 Line Level, Frequency

4 Overhead Bits 9 Network Prop. Delay
```

```
RX-SYSTEM
Frequency  = 1544000 Hz Offset = -20 ppm
System     : T1ESF
Input Mode : BRIDGING      Code : HDB3
Test Mode  : FRAMED

 DATA     704k    T1SF   T1SFns    MORE
```

```
RX-TEST PATTERN
Test Mode     : FRAMED

Sync to       : QRSS

..Octet Bits : ALL 8
Carrying      : 00000000 00000000
 QRSS  PRBS  REPWORD  LIVE
```

```
RX-OVERHEAD BITS

A Bit          : 0
```

```
RX-SIGNALLING MONITOR
Mode     : SINGLE CHANNEL MONITOR
Channel : 1        ABCD


Dialled Number : 123x56x8x0
Error Code     :    1  2  3
SINGLE  ALL  DTMF
```

```
RX-LINE LEVEL,FREQUENCY
Frequency  = 1544000 Hz Offset = -20 ppm

RX Input   : UNBALANCED
Line Level = 0.000  V
           = 0.0  dB relative to 2.370 V

 BAL    UNBAL
```

```
RX-NETWORK PROP. DELAY

Mode  : READY
Delay = 0.000      ms
    ( = 0          bits )


 STOP    EXECUTE
```

DATA

```
RX-MENU

1 System
2 Coding
3 Pattern
4 Control Lines (Tx & Rx)
5 Network Prop. Delay
```

```
RX-SYSTEM
Frequency  =2048000 Hz  Offset = -20 ppm
System     : RS-232 DTE

Test Mode  : SYNC
Clock      : FROM DCE         Sense : True
Bit Rate   : 9.600    kbit/s
  PCM    232 DTE  232 DCE  CO-DIR  MORE
```

```
RX-ASYNC CODING

Bit Rate   : 9600 bit/s
Data Bits  : 7
Parity     : NONE
Stop Bits  : 1

   5       6       7       8
```

```
RX-PATTERN

Carrying  : PRBS
..Length  : 2^15 ..Sense : INVERT

Carrying  : 00000000 00000000

 PRBS      WORD
```

```
TX/RX CONTROL LINES
Tx:                  Rx:
RTS : 1              CTS  : 0
DTR : 1              DSR  : 0
RL  : 0              RLSD : 0
LL  : 0              TM   : 0
Delay : READY             = 0     ms
 STOP   EXECUTE
```

```
RX-NETWORK PROP. DELAY

Mode  : READY
Delay = 0.000      ms
    ( = 0          bits )


 STOP    EXECUTE
```

Fig. 3-5   Examples of typical pages

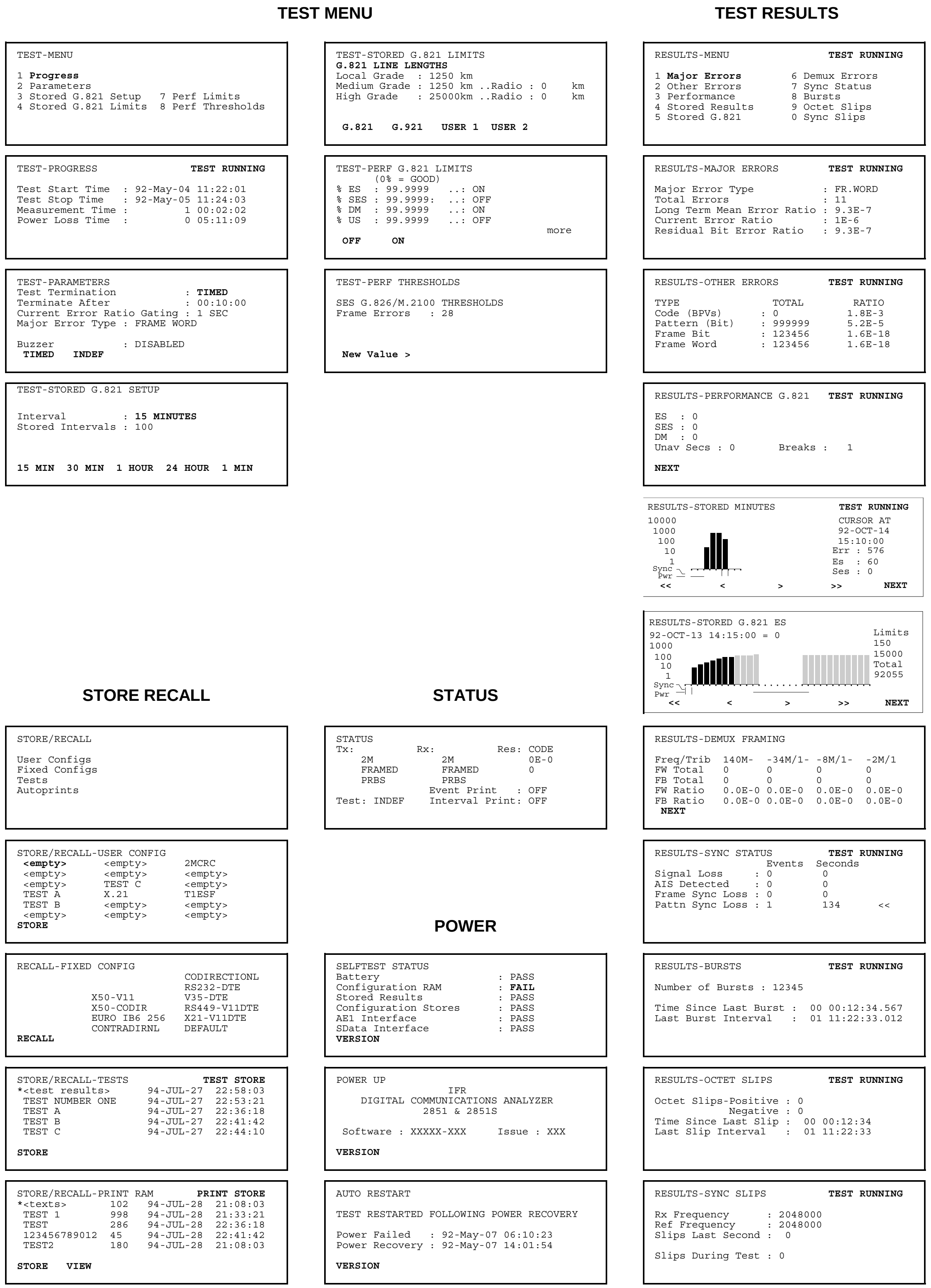


Fig. 3-5 Examples of typical pages (contd.)

Configure pages

```
CONFIGURE-MENU

1 Ports                  6 Printer
2 Time / Date            7 Event Print
3 Version                8 Interval Print
4 Options                9 Signalling
5 Switch Unit
```

Note **Time/Date cannot be changed when a test is running.**

Configure-port

Select the use of the RS-232 port to be either for connection to a remote controller, printer, printer sharer or a terminal. If the GPIB option is fitted the GPIB port can be selected for connection to a remote controller or a printer instead of the RS-232 port. Making a conflicting selection on one port will select NONE on the other port.

Remote operation

Refer to Chapter 4.

Printer and printer sharer operation

Refer to Page 3-91.

RS-232 terminal operation

A VT100 type VDU and keyboard (Terminal) can be connected via the RS-232 port to provide a large display of 2851 text and remote control using the keyboard to emulate 2851 key functions. The VDU displays the same page as the 2851 together with a simulation of the Alarm LEDs to provide continuous monitoring of Alarm conditions.

Assign RS-232 port to TERMINAL.

Select Baud Rate, Format and Handshake as appropriate to the terminal in use.

The Terminal keyboard equivalents of the 2851 front panel keys are listed below:-

2851 KEY	TERMINAL KEY (VT100)
LAST PAGE	<
CONFIGURE MENU	CTRL + C
TX-INJECT	CTRL + E
TEST-STOP	CTRL + F
TEST-START	CTRL + G
DELETE	CTRL + H
TX-AIS	CTRL + I (Switch on/off)
LAMPLOCK	CTRL + L (Switch on/off)
ENTER	CTRL + M
RX-MENU	CTRL + R
TX-MENU	CTRL + T
TEST-MENU	CTRL + V
TEST-RESULTS-MENU	CTRL + W
STATUS	CTRL + X
STORE RECALL	CTRL + Z
Arrow keys	AS VT100
Soft key	Numeric keypad Keys 1-5

The key equivalents can be displayed on the VDU in TERMINAL mode with the CONFIGURE-PORT page displayed and with the selection for 'RS-232 Used for:' highlighted. Either press the number [3] key on the Terminal numeric keypad or press the *[TERMNAL]* softkey on the 2851. Press either key to remove or display the key equivalents as required.

Note

In TERMINAL mode the terminal keyboard will be locked when the 2851 keyboard is locked. The 2851 keyboard cannot be locked or unlocked via the terminal keyboard, (Lock/Unlock 2851 by pressing [SHIFT] plus a soft key.)

A personal computer running terminal emulation software may be used as a terminal.

Letter keys may be used for text entry (e.g. store labels) or for short cuts when *New Value* string is not displayed.

Configure-time/date

Set the 2851 internal clock as follows:-

Enter the real time numerically:	hour.minute.second
Displayed as:	hour:minute:second
Enter the real date numerically:	year-month-day.

Configure-version

Displays hardware and software fitted and also any option cards fitted - GPIB or 34 M Framed or X.50 option cards, for example. Thus this page indicates the capabilities of your 2851.

Receiver Card : AD11/02 indicates - Fitted with Receiver board type AD11 and with added option 02.

The Receiver board fitted can be either AD11, AD12, AD98 or AD99 with option details as below.

Receiver board/options	Bit rates (Mbit/s)					
AD11/01			2			8
AD11/02		1.5	2			8
AD11/03	0.7		2			8
AD99/04	0.7	1.5	2	3	6	8

For details of GPIB option and operation refer to Chapter 4.

Configure-options

In this page:-

Enable or disable the autoskip function.	When enabled the highlighted field moves after the field update to the next option.
Select voice encoding.	Mu or A.
Select language for the display.	
Enter the ERRORS LED threshold.	
Enable or disable code excess zeros count.	Enable this function if you want excess zeros in the line code to be recorded as errors. Eg. if 4 zeros were detected between two violation pulses in a received HDB3 encoded line signal, the 4th zero is recorded as a line error.

Configure - switch unit

When the Data Interface Switch adapter unit (Option 23) is fitted this page allows the parameter options to be selected.

For operating details refer to the Data Interface Switch Operating Manual, part no. SKH 8354-OM which is supplied with the unit.

Configure-printer

(Refer to page 3-91, Printer and Printer Sharer operation).

In this page select:

Printer type & terminator
Printout identity number and label
Print to Printer or RAM

Configure-event print

(Refer to page 3-91, Printer and Printer Sharer operation).

Events are specified and when they occur during a test the results are automatically printed (Print on event). Alternatively the test results can be sent to RAM and stored for later examination/printing by setting Print to RAM in the CONFIGURE-PRINTER page.

Print on event

Automatically prints results during a test on the occurrence of a specified event. Required port for printing must be set to PRINTER or PRINTER SHARER in the CONFIGURE MENU PORT page.

Select Event Print ON/OFF. (Keyboard shortcut is [SHIFT] + [P] key.)

Select any of the following events:-

Alarm change.	A message is printed if the alarm has changed.
Errored second.	A relevant message is printed when an errored second, burst error or octet slip is detected.
Signalling/ISDN change.	A message is printed either when the signalling is changed, signalling code changed, when a dialling sequence is received or when the ISDN error report bits change.
Error ratio threshold crossed.	A relevant message is printed when the selected threshold is crossed in either direction. The measured error type is the major error selected in the TEST-PARAMETERS page.
Performance Limit exceeded	A relevant message is printed when a performance limit is exceeded.

Print to RAM

Make selections for event as described above but

Select Print to RAM in the CONFIGURE-PRINTER page

During the test the autoprint text is sent to RAM instead of directly to a printer. Text can then be stored in a named file for later viewing or printing as selected via the STORE RECALL menu.

See section headed *"Autoprints"* on page 3-26 for store and recall details.

Configure-interval print

(Refer to page 3-91, Printer and Printer Sharer operation).

Intervals are selected and at the end of these a summary of accumulated errors and measurements is automatically printed (Print on interval). Alternatively the summary can be sent to RAM and stored for later examination/printing by setting Print to RAM in the CONFIGURE-PRINTER page.

Print on interval

Automatically prints a summary of accumulated errors and measurements at the ends of selected intervals. Required port for printing must be set to PRINTER or PRINTER SHARER in the CONFIGURE MENU PORT page.

Select Interval Print ON/OFF. (Keyboard shortcut is [SHIFT] + [I] key.)

Select Print Interval.

Select any of the following errors and measurements.

Major errors.	Total errors, long term mean error ratio and residual error ratio for the Major error type as selected in the TEST MENU-TEST PARAMETERS page.
Other errors.	Code errors, pattern errors, framing errors and CRC errors.
G.821	G.821 measurement results.
G.826	G.826/M.2100 measurement results.
Stored results.	The start time and date of the interval, details of the stored errors that have occurred ie. time, number of errors and status and finish time and date of interval.
Sync slips.	The number of sync slips that occurred in the current second and the total number of sync slips that occurred since the start of the test.
Demux errors. (Mux/Demux selected) 2852(S), 2853(S) Option 14 or 2854S, 2855S	Demux Frame Word and Frame Bit errors, and Demux Performance G.821 errors.
SData errors (Option 24)	Structured data pattern errors and framing errors as selected in the TEST MENU - TEST PARAMETERS page.

Print to RAM

Make selections for interval as described above but

select Print to : RAM in the CONFIGURE-PRINTER page.

During the test the autoprint text is sent to RAM instead of directly to a printer. Text can then be stored in a named file for later viewing or printing as selected via the STORE RECALL menu.

See section headed *"Autoprints"* on page 3-26 for store and recall details

Configure-signalling

In this page define the signalling parameters for the RX-SIGNALLING MONITOR page:-

Enter periods for Pulse break, Inter-pulse break and Inter-digit pause.

Enter Pulse break and Iner-pulse break codes. (Break and Make codes.)

Enter dial map.

Dialling pulse parameters

Enter values for the following:-

Pulse break minimum:	Where the value must be greater than 0 but less than the pulse break maximum value in milliseconds.
Pulse break maximum:	Where the value must be greater than the pulse break minimum value but less than 999 in milliseconds.
Inter-pulse break minimum:	Where the value must be greater than 0 but less than the inter-pulse break maximum value in milliseconds.
Inter-pulse break maximum:	Where the value must be greater than the inter-pulse break minimum value but less than the inter-digit pause minimum value in milliseconds.
Inter-digit pause minimum:	Where the value must be greater than the inter- pulse break maximum value but less than 999 in milliseconds.

Pulse break and Inter-pulse break codes

Edit a value for the Pulse break code (dial break) which can be a 2 or 4 bit word.

Edit a value for the Inter-pulse break code (circuit seized) which can be a 2 or 4 bit word.

Note **The Pulse break and Inter-pulse break codes must be different to enable the Rx-Signalling Monitor to detect a dialling sequence.**

Dial mapping

Select System Dial Map :-

Dial Map 0 to 9 :	0 = 1 pulse. 9 = 10 pulses.
Dial Map 1 to 9 then 0 :	1 = 1 pulse. 9 = 9 pulses. 0 = 10 pulses.
Dial Map 9 to 0 :	9 = 1 pulse. 0 = 10 pulses.
Dial Map 0 then 9 to 1 :	0 = 1 pulse. 9 = 2 pulses. 1 = 10 pulses.

Dialling terms and definitions

A dialled digit is identified by detecting the number of transitions between the Pulse break and Inter-pulse break signalling codes. A Pulse break or Inter-pulse break code must be stable for three consecutive multiframes for it to be valid. A long period of Inter-pulse break codes between a dialled digit is the Inter-digit pause period.

A dialling sequence is concluded by the last Inter-pulse break code period extending into an Inter-digit pause period which is greater than the Inter-digit pause minimum period.

For a system using dial map 1 to 9 then 0 :-

A dialled digit 4 is identified by 4 code transitions as shown below:-

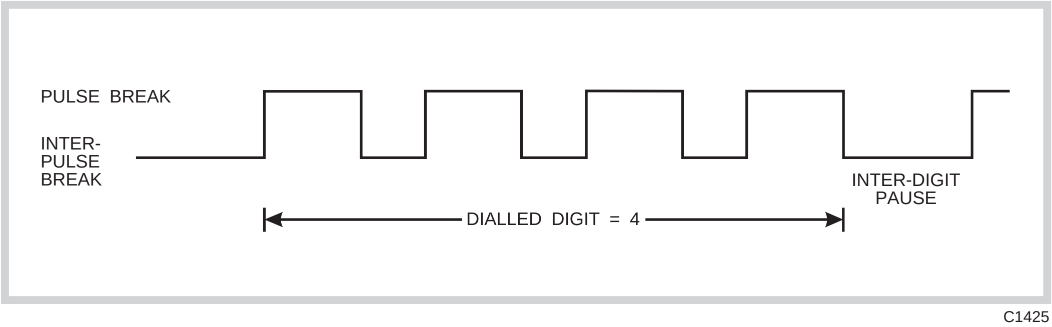


Fig. 3-6 Dialling sequence for digit 4 using dial map 1 to 9 then 0

PCM transmitter pages

```
TX-PCM MENU

1 Summary             6 Overhead Bits
2 Clock, AIS          7 Signalling
3 Pattern             8 Sequence Tests
4 Error Injection     9 Loopback
5 Nx64 Channels       0 Mux Control
  MODE
```

Note

Tx-System cannot be changed when Tx is on.

When Tx system is changed or if the same Tx system is re-selected, certain default conditions are set. (See Appendix A).

Sequence Tests cannot be executed when Tx is off.

TX-summary

Displays a summary of transmitter functions selected and allows them to be changed. Functions below marked with * can also be selected in other Tx pages:

Transmitter on/off	(Keyboard short cut is [SHIFT] + [T] key).
Digital system.	
AIS on/off.	(Keyboard short cut is [SHIFT] + [A] key).
* Clock source.	
Line code.	
* Test mode.	
Bank (1544 kbit/s systems)	

System

Note

System refers to the transmitted signal except when in Mux mode when it is the "Mux From" system.

Refer to Appendix C for list of framing systems and details.

Select NON-STD to test via an unframed NRZ digital system between 1 kbit/s and 11000 kbit/s. Enter the bit rate required unless using external clock.

For 2048 kbit/s systems only, the line signal is also transmitted from the DATA interface if an X.21, RS-449 or V.35 cable (DTE or DCE) is fitted.

If selection of 34 M or 140 M Unframed system is required and instrument has Mux/Demux facility, first set TX-MUX and RX-DEMUX CONTROL operation to OFF. With Mux set to ON system selections are limited to 2 M, 8 M or 34 M. (See Appendix A, Note 6).

Keyboard shortcut is [SHIFT] + [M] - Mux ON/OFF.
[SHIFT] + [D] - Demux ON/OFF.

Eurocom D/1 IB5 system

With receiver board AD98 fitted (Option 25) the Eurocom D/1 IB5 system (unframed) with bitrates of 256, 512 and 1024 kbit/s is also available for selection.

TX-clock, AIS

In this page:-

Select:- Clock source.
Internal clock rate offset, and output.
AIS and zeros.

Clock source

The transmitter uses a clock signal to transmit a digital signal. The clock signal may be derived from one of the following sources:-

Internal	- Variable or Fixed clock signal generated by the frequency synthesizer within the 2851.
External	- Clock signal from an external source (via BNC CLOCK IN connector).
External TTL	- A DC coupled (gapped) clock signal from an external source (via AUX connector, see Chapter 2).
External 34 M or 140 M	- Clock signal from an external 34 M or 140 M system source (via BNC TX EXT CLK IN rear panel connector).
Receiver	- Clock signal derived from the received digital signal.

Internal clock rate and offset

Variable mode

The clock signal generated by the 2851 frequency synthesizer (locked to the VCO) can be adjusted to operate –96 kHz to +96 kHz in steps from the nominal bit rate frequencies. For bit rates up to 3 Mbit/s, the steps are 2 kHz or 8 kHz. For bit rates of 3 Mbit/s and above, the steps are 8 kHz. The frequency can be further adjusted by setting an offset between –150 ppm to +150 ppm in steps of 5 and 25 ppm. For 34 Mbit/s the offset can be set in steps of 5 and 25 ppm up to a maximum of ± 60 ppm and for 140 Mbit/s in steps of 5 and 25 ppm up to a maximum of ±100 ppm. The [0] soft key is used to reset the clock offset to zero.

Note **Frequency offset is set to zero if system or clock rate are changed.**

Fixed mode

The 2851 synthesizer is locked to the temperature controlled crystal oscillator to generate a higher accuracy clock signal.

The clock rate is displayed but cannot be changed, (..Offset is not displayed).

Output

For 34M or 140M unframed system the output sense can be true or inverted.

AIS zeros

An alarm indication signal (unframed all ones) can be selected on or off. The number of zeros can be set to none or can be in the range 1×10^{-7} to 9×10^{-2}.

Note **AIS on/off keyboard short cut is [SHIFT]+ [A] key.**

TX-pattern

In this page:-

Select: Test mode.
Test pattern (Carrying).
Fill pattern.

Test mode

Note that when the Test mode is changed certain default conditions are set for the TX-PATTERN (see Appendix A).

Unframed

Continuous pattern data without frame structure.

Framed

Pattern data fills all channels of the framed digital signal.

Single

The selected pattern option fills the selected single channel of the framed digital signal.

Trib 1-4

Pattern data fills one of four tributaries in the digital signal e.g. for 8448 kbit/s systems each tributary is a 2048 kbit/s signal. Each tributary is interleaved in a sequence specific to the framing system selected. (See Appendix C).

Note **A tributary comprises pattern data only i.e. it is unframed.**

N×64

As single except that pattern data is distributed amongst the N selected 64 kbit/s channels.

D&I (Drop and Insert) and D & I (N) - (Drop and Insert N×64)

The selected channel of the received signal is replaced by the selected Tx test pattern. The Transmitter and Receiver must be set to the same framing system. The clock source for the Transmitter is automatically taken from the extracted clock for the receiver. In this mode there are no Sequence Tests or Overhead Bits Control available.

Note **If Channel is set to zero, the Transmitter will re-transmit the entire received digital signal.**

Carrying

PRBS

A pseudo-random-bit-sequence signal specified by length, sense, octet bits and depending on system, limit.

PRBS length can be set to:-

$2^9–1$, $2^{11}–1$, $2^{15}–1$, or $2^{20}–1$ (except 34 & 140 Mbit/s).
$2^{15}–1$, $2^{18}–1$, $2^{20}–1$, $2^{23}–1$, $2^{25}–1$ or $2^{28}–1$ (34 Mbit/s - 2852(S) & 2853(S)).
$2^{15}–1$, $2^{18}–1$, $2^{20}–1$, $2^{23}–1$, $2^{25}–1$, $2^{28}–1$ or $2^{31}–1$ (34 & 140 Mbit/s - 2854S & 2855S).

PRBS sense can be set to true or inverted.

Octet bits in framed signals can be set to 7 data bits plus 1 fixed bit (7 + 1) or just 8 data bits (all 8). For '7 + 1', PRBS data fills the first 7 bits but the eighth bit is always a 1. For 'all 8', PRBS data fills all 8 bits in an octet.

PRBS limit sets the number of successive zeros per PRBS sequence to either 7, 14 or no limit at all (1544 kbit/s systems).

QRSS

A pseudo-random-bit-sequence signal with length 2^{-20}, zero limit 14 and sense true (1544 kbit/s systems).

Word or Word 16

A 16-bit binary word.

Word 8

An 8-bit binary word (34 & 140 Mbit/s only).

Word 24

A 24-bit binary word (34 & 140 Mbit/s only).

Voice (external)

Encodes an externally applied audio signal into a 64 kbit/s signal for insertion into a selected transmit channel (1544 and 2048 kbit/s systems).

Data

Inserts a 64 kbit/s data signal from an external source into a selected transmit channel. External data can be selected to be codirectional, contradirectional or DSO encoded data via the 64 kbit/s connector or NRZ data via the AUX connector. X.21, V.35 or RS-449 options are also available when the appropriate data cable is connected.

The Timing parameter controls whose the 64 kbit/s clock is sourced from (Tx or Rx). When set to FROM TX, the 64 kbit/s clock is derived from the outgoing PCM signal (e.g. 2M) and provided to the external 64 kbit/s transmitter as the clock source. When set to FROM RX, the 64 kbit/s clock is derived from the incoming PCM signal (e.g. 2M).

As a result, FROM TX is only available when the Tx is transmitting a PCM signal with 64 kbit/s content, and FROM RX is only available when the Rx is receiving a PCM signal with 64 kbit/s content.

All 1

Continuous data sequence of 111 etc.

All 0

Continuous data sequence of 000 etc.

Alt 10

Alternating sequence of 1010.

1 kHz

A digital representation of a sinusoidal signal of 1 kHz/0dBm0 (2048 kbit/s systems).

2 Words

Two programmable 8-bit sequences alternated by an external TTL input signal via the AUX connector. The changeover occurs at the end of 8 bits.

Fill pattern

One of the following patterns can be used to fill all channels except the test channel in the transmitted digital signal:-

PRBS

PRBS $2^{15}-1$.

Word

A programmable 8-bit word allowing all ones, all zeros and alternating ones/zeros etc. to be set up.

TX-error injection

In this page:-

Select:- Error mode (Manual or Rate).
Target bits.
Error type.
Single, Burst or CRC Block.
Burst size.

Injection

Enable or disable error injection.

Note **Error injection enabled/disabled keyboard short cut is [SHIFT] + [E] key.**

Mode

Manual - Inject single errors or burst errors by pressing the INJECT key.

Rate **-** Injects single errors or burst errors automatically at a rate in the range:-
3×10^{-1} to 1×10^{-7} (not 34 & 140M bits).
3×10^{-2} to 1×10^{-8} (34M bits -2852(S) & 2853(S)).
9×10^{-2} to 1×10^{-8} (34M Unframed patterns & 34M/8M code)
9×10^{-3} to 1×10^{-9} (140M Unframed patterns) -2854(S) & 2855(S)).
9×10^{-2} to 1×10^{-7} (Frame words).

Target bits

Framing - Inverts framing bits.
Pattern - Inverts test pattern bits. A pattern can be in a single channel of a framed structure, in all channels or an unframed signal.
CRC - Inverts CRC bits.
Any bit - Enables the user to inject errors into any channel bit before being transmitted.

Tx-Test mode must be set to DROP & INSERT CHANNEL (channel set to 0) or DROP & INSERT (N×64) (N set to 0).

With these conditions set the received bit stream is transmitted unmodified and no pattern inserted. The injected errors are distributed evenly throughout all channel bits.

2M FR
8M FR
34M FR
140M FR

With Mux set to ON inverts framing bits in the selected system

Inject
(See Fig. 3-7)

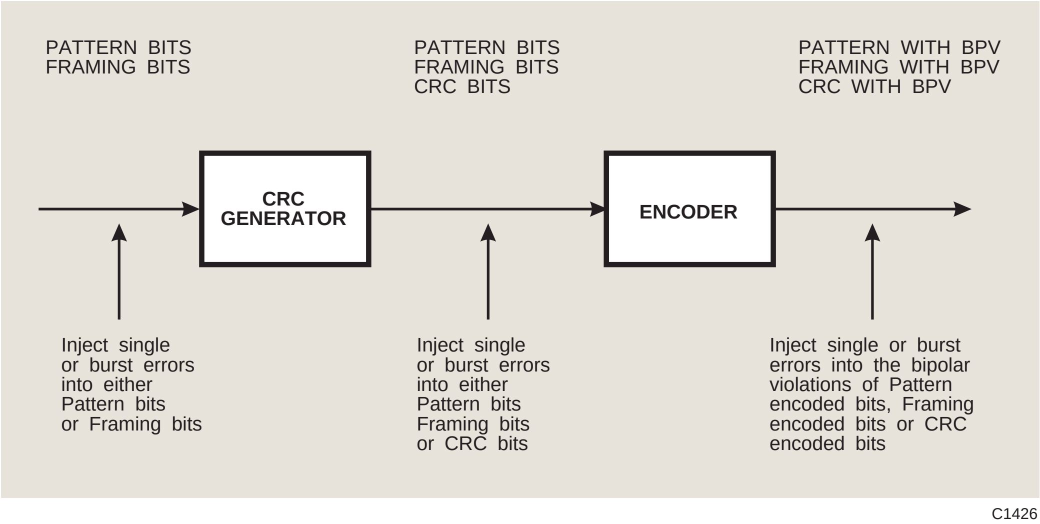


Fig. 3-7 Error injection options

BPV (bipolar violations)

In the encoded data, a Mark is forced to be a zero or a Zero is forced to be a Mark at the same polarity as the last Mark transmitted.

Bit errors

A binary digit which is inverted before the bit stream is encoded.
If the system uses CRC, bit errors can be injected either before or after CRC is generated.

Singly

A single bit is errored.

In Bursts

Bit or BPV errors are introduced into the target bits by modulating with a pseudo- random-sequence. Burst size can be 8, 16, 32, 64, 128 or 256.

Note

The actual transmitted error ratio in a signal with bursts at a fixed rate is given as:- The burst rate × the burst size e.g. a burst size of 16 at a rate of 2×10^{-6} would be measured 3.2×10^{-5}.

In some situations it is possible for the measured error rate of target bits to be less than the selected burst rate because each burst starts at a target bit in a channel but may also error other non-target bits in neighbouring channels.

In CRC blocks (G.96Y)

For 2MCRC and 2MCnoMF systems with CRC selected as the target bit and Rate selected as the mode, CRC block errors can be injected.

The number of errored blocks in 1 second can be selected in the range 1 to 999 for ES & SES and 1 to 999 in 1 minute for DM, a further selection enables the USER to enter an errored block rate of 1-999 in 1 second or 1 minute.

TX-N×64 channels

This mode is similar to the Framed Single Channel except that pattern data is sequentially distributed amongst the N selected 64 kbit/s channels. It is only available on systems with bit rates up to and including 2048 kbit/s excluding systems with robbed bit signalling.

Test Mode must be set to N×64 before this page can be accessed.

All channels available for selection are displayed and those currently selected are shown in reverse video.

Channel selection

Two modes of selecting the N×64 channels are available - GROUP or CURSOR (selected by right hand soft key).

In GROUP mode the channels are selected by pressing the *[SET N]* or *[RESET N]* softkey and then entering the list of channels to set or reset. The list can be a single channel, a series of channels, a group of channels or any combination of these, e.g.

Single channel	:	1	=	channel 1 only
Series of channels	:	1.3.5	=	channels 1, 3 and 5
Group of channels	:	1-5	=	channels 1 to 5 inclusive
Combination	:	1.3.5-8	=	channels 1, 3 and 5 to 8

In CURSOR mode position the flashing cursor on the channel required and press *[SET]* or *[RESET]*. This mode affects only the particular channel selected.

Both modes of operation allow a CLEAR facility to clear all selected channels from the list and a COPY (Tx→Rx) facility to copy the current N×64 selection to the RX selection. Both of these facilities prompt the user for confirmation.

TX-overhead bits

Select and edit the Tx overhead bits (structure bits). Refer to the 'Bit Control' section of the appropriate framing system in Appendix C for details of overhead bits controlled. Note that for T1ESF systems the overhead bits constitute a 16 bit Facility Data Link Message.

The Mux overhead bits page is accessed by moving highlight to *more...* in the display field and pressing *[NEXT]* soft key. To return to the first page, highlight *more...* and press *[NEXT]*.

TX-signalling control

In this page select mode - Channel Associated or DTMF or Framed C-bit.

For Channel Associated select the active signalling channel and signalling code and the other (idle) channels signalling code. Select the number to be dialled and dial to simulate a call set-up.

For DTMF select the signalling channel and set the tone for dialling or single shot. Select the number to be dialled and dial to simulate a call set-up.

For Framed C-Bit select the active signalling channel and signalling code bits ABD and the other channels signalling code. Enter the C-Bit sequence.

Channel associated

Channel

Enter a channel to carry the signalling code. This is the active channel.

Note

Selecting active channel 0 stops transmission of the active channel signalling code and transmits all channels with the idle channel code.

Signalling codes

Select the signalling code for the channel selected above. This is the active channel code and is displayed in binary and decimal.

Select the signalling code for all the other channels (idle channels) which is also displayed in binary and decimal.

Dialling

Highlight Dial Number and press *[DIAL]* soft key to dial the existing number displayed.

To select a new number, press *[NEW NO.]* softkey and enter a string of up to 19 characters. This can consist of digits 0 to 9 and embedded pause character 'space'. The pause character will result in an extended Inter-Digit Pause (see Note below).

Entering the new number returns DIAL as an option. Press *[DIAL]* soft key and the existing dial number (displayed) will be dialled.

Prior to any dialling sequence the selected (active) channel will contain the user specified 'Code in Active Channel' as set on this page. On execution of the dialling sequence, any current dialling sequence will be aborted first. On termination of dialling, the user specified 'Code in Active Channel' will again be transmitted in the active channel.

Note **Dialling parameters are set by the user on CONFIGURE-SIGNALLING page and these determine the codes and durations for the dialling sequence.**

The duration of the Inter Pulse Break and Pulse Break (Make and Break) codes is the mid range value of the appropriate min/max value selected by the user. The duration of the extended pause between dialled digits is the Inter-Digit Pause extended by 25%.

DTMF

Channel

Select a channel to carry the DTMF tones.

Note **DTMF uses the same channel as the Test Pattern and changes to the channel on the DTMF page affects the channel into which the Test Pattern is inserted.**

Dialling mode

Select the dialling mode - Dial or Single shot.

DTMF parameters

Select the tone on/off periods and the pause duration.

Dialling

Set dialling mode to DIAL.

Highlight the Dial Number and press *[DIAL]* soft key to dial the existing number displayed.

To select a new number, press *[NEW NO.]* and enter a string of up to 19 characters.

(For characters '*' and '#' select [.] and [-] on the keyboard).

Entering the new number returns *[DIAL]* as an option.

Press *[DIAL]* soft key and the displayed new dial number will be dialled.

Single shot

Set dialling mode to SINGLE SHOT.

Highlight Send Tone and using the numeric keypad enter the required characters.

Each single character is dialled as it is entered

Framed C-Bit

In this mode the normal control of the C-bit within the signalling bits ABCD is replaced by a dedicated 15 bit sequence.

Enter a channel to carry the signalling code.
Select the signalling code bits ABCD for the active channel and ABCD for the other channels (idle channels).
Select and enter the 15 bit sequence for the C-bit using the soft keys.

The first bit serves as the framing bit and follows a fixed sequence itself. The other 14 bits are then used for dedicated flags as follows:

bit 2 “Escape”
bit 3 “HDB3 Loopback Address”
bit 4 “Loopback Source”
bit 5 “Loopback 2”
bit 6 “Loopback 3”
bit 7 “HDB3 Loopback”
bit 8 “ARC Loopback”
bit 9 “Fault”
bit 10 “Local Fault”
bit 11 “Remote Fault”
bit 12 “Subscriber Power Fault”
bit 13 “Subscriber Unavailable”
bit 14 “Reserved”
bit 15 “Reserved”

These descriptions are available to the user by highlighting the bit number on the page and entering the appropriate number.

Note that there is no decimal equivalent for the signalling code in the active channel as the C-bit is undefined (shown by the binary digit being replaced by the character C) and the channel number also has the corresponding timeslot shown. Channels 1 to 15 associate to timeslots 1 to 15 but channels 16 to 30 associate to timeslots 17 to 31.

TX-sequence tests

This page allows the simulation of alarm conditions and alignment strategies. The types of tests available depend on the digital system.

When Tx is on, execute and stop the tests required.

The Mux sequence tests page is accessed by moving highlight to *more...* in the display field and pressing *[NEXT]* soft key. To return to the first page, highlight *more...* and press *[NEXT]*.

TX-loopback (1544 kbit/s systems)

Data transmitted by the 2851 can be returned (looped back) by an equipment at another location on the digital line. The remote equipment must be able to recognize an unframed pattern to establish remote loopback (Make Code) and another unframed pattern to open the loop (Break Code). Two loopback patterns are available for transmission by the 2851 and are identified 'A' and 'B'. The provision of two patterns allows remote loops to be quickly open or closed where two remote equipments are used on the same line.

Enter the number of bits from 3 up to 16 and the binary code for the Make and Break codes.

Highlight 'Loopback Mode : INACTIVE'

```
TX-LOOPBACK
                Bits  Code
Make Code A   : 5     10000
Break Code A  : 3     100
Make Code B   : 4     1100
Break Code B  : 4     1110
Loopback Mode : INACTIVE
 ABORT   MAKE A  BREAK A  MAKE B  BREAK B
```

Establish remote loop by pressing *[MAKE A]* or *[MAKE B]* as required.

Pressing *[MAKE A]* displays MAKE CODE A ACTIVE and the top line message *LOOPBACK A SET*:-

```
TX-LOOPBACK                 LOOPBACK A SET
                Bits  Code
Make Code A   : 5     10000
Break Code A  : 3     100
Make Code B   : 4     1100
Break Code B  : 4     1110
Loopback Mode : MAKE CODE A ACTIVE
 ABORT
```

The top line message is there to remind you to send BREAK CODE A before disconnecting from the remote equipment.

The *[ABORT]* softkey allows you to stop transmitting the loopback code if required otherwise, the MAKE CODE is transmitted for approximately 5 seconds after which 'Loopback Mode : INACTIVE' is displayed:-

```
TX-LOOPBACK                 LOOPBACK A SET
                Bits  Code
Make Code A   : 5     10000
Break Code A  : 3     100
Make Code B   : 4     1100
Break Code B  : 4     1110
Loopback Mode : INACTIVE
 ABORT   MAKE A  BREAK A  MAKE B  BREAK B
```

Open the loop by highlighting 'Loopback Mode : INACTIVE' and pressing *[BREAK A]* or *[BREAK B]* as required.

Pressing *[BREAK A]* removes the top line message and displays BREAK CODE A ACTIVE:-

```
TX-LOOPBACK
                Bits  Code
Make Code A   : 5     10000
Break Code A  : 3     100
Make Code B   : 4     1100
Break Code B  : 4     1110
Loopback Mode : BREAK CODE A ACTIVE
 ABORT
```

The *[ABORT]* softkey allows you to stop transmitting if required.

The BREAK CODE is transmitted for approximately 5 seconds after which, 'Loopback Mode : INACTIVE' is displayed.

TX-mux control

Select the Mux function (ON or OFF) and select the input and output tributary level - From and To field.

Having set the input tributary level to 2, 8 or 34 Mbit/s, the signal within the selected tributary can be set using the TX-MENU Summary and other pages, and can be any of the 2M or 8M systems normally available or 34M Unframed. For example if a 2 Mbit/s system is selected, the test signal can be unframed or a 64 kbit/s or N×64 kbit/s test pattern. Equally if an 8 Mbit/s system is selected the test signal can be unframed or for example a 64 kbit/s test pattern within a G.744 system. Other parameters can also be controlled in the selected tributary such as overhead bits and signalling.

The clock source can be INTERNAL or EXTERNAL. For INTERNAL clock the output can be offset in 5 or 25 ppm steps to a maximum of ±60 ppm (34 Mbit/s) or to ±100 ppm (140 Mbit/s) so that frequency margin measurements can be performed at 34 & 140 Mbit/s (the [0] soft key is used to reset the clock offset to zero). Where frequency margin measurements are required at 8 Mbit/s this should be done with the Mux control set to OFF, selecting an 8 Mbit/s system from the TX-MENU Summary page, and then offsetting the clock on the TX-MENU Clock, AIS page.

Tributary selection is made using the tributary selection fields as appropriate. The fill pattern in other tributaries can be set to ALL 1, ALL 0, ALTERNATING 1/0, PRBS or a COPY of the test signal in the selected tributary.

PCM receiver pages

```
RX-PCM MENU

1 System            6 Signalling Monitor
2 Test pattern      7 Line Level, Frequency
3 Nx64 Channels     8 ISDN Error Report Bits
4 Overhead Bits     9 Network Prop. Delay
5 Alarms            0 Demux Control
   MODE
```

Note **Certain Rx parameter options cannot be changed when a test is running.**

When the Rx system is changed or if the same Rx system is re-selected, certain default conditions are set (See Appendix A).

RX-system

In this page:-

Select:- System.
Bank (1544 kbit/s systems).
Test mode.
Input.
Line code.
Clock (Non STD system only)
ALBO

System

Refer to Appendix C for list of framing systems and details.

Note **System refers to the received signal except when in Demux mode when it is the "Demux To" system.**

Select NON STD to test an unframed NRZ digital signal between 1 kbit/s and 11000 kbit/s. Enter the bit rate required.

If selection of 34 M or 140 M Unframed system is required and instrument has Mux/Demux facility, first set RX-DEMUX and TX-MUX CONTROL operation to OFF. With Demux set to ON system selections are limited to 2 M, 8 M or 34 M. (See Appendix A, Note 6).

Keyboard shortcut is [SHIFT] + [D] - Demux ON/OFF.
[SHIFT] + [M] - Mux ON/OFF.

Eurocom D/1 IB5 system

With receiver board AD98 fitted (Option 25) the Eurocom D/1 IB5 system (unframed) with bitrates of 256, 512 and 1024 kbit/s is also available for selection.

Clock-NON STD system only

Select the clock source to be one of the following:

External TTL - A gapped clock signal from an external source (via AUX).

External 34 M, NRZ - Clock signal from an external 34 M system source (via 34 M NRZ 2852(S) & 2853(S)).

External 34M, TTL Clock signal from an external 34M system source (via RxCLK IN –2854S & 2855S).

External 140 M, ECL - Clock signal from an external 140 M system source (via RX CLK IN - 2854S & 2855S).

Test mode

Sets the Receiver to expect a particular digital signal or particular parts of a digital signal.

Note that when the Test mode is changed certain default conditions are set for the RX-TEST PATTERN (See Appendix A).

Unframed:	The Receiver expects a whole unframed signal.
Framed :	The Receiver expects a framed signal and tests all channels as one.
Single :	Access a specified channel of the received framed digital signal.
Trib 1-4 :	Access one of the tributaries in the received digital signal.
N×64:	As Single except that the test patterns are distributed amongst the N selected 64 kbit/s channels.

Input

The following input modes can be selected:

Terminated	Terminates the digital line with an impedance of 120 Ω Balanced (Option 01) or 100/110 Ω Balanced (Option 05) or 75 Ω Unbalanced.
Bridging	Directly taps a terminated digital line with an impedance of greater than 1 kΩ.
Monitor	Connect to a protected monitor point or to an unprotected monitor point via a monitor probe.
NRZ	Selects an external TTL NRZ data signal at the line rate via the AUX connector.
V.35, X.21 or Rs-449	Selects the V.35, X.21 or RS-449 signal as input. Only available for 2048 kbit/s systems and if the appropriate data cable (DTE or DCE) is fitted.

ALBO

ALBO (Automatic Line Build Out) allowing up to 30 dB of cable attenuation.

ALBO is available for 2048 kbit/s systems (Option 01 but not with Option 04 fitted) or 1544 kbit/s systems (Option 05 but not with Option 07 fitted) when Input mode TERMINATED or BRIDGING.

RX-test pattern

In this page:-

Select:- Test mode. Described under RX-SYSTEM.
Synchronizing signal.
Loudspeaker on/off when External voice selected.
(Keyboard shortcut is [SHIFT] + [S] key.)

Sync to

Select the expected pattern to which the receiver can synchronize.

PRBS

A pseudo-random-bit-sequence signal specified by length, sense, octet bits and depending on system, limit.

PRBS length can be:-

$2^9–1$, $2^{11}–1$, $2^{15}–1$, or $2^{20}–1$ (not 34 & 140 Mbit/s)
$2^{15}–1$, $2^{18}–1$, $2^{20}–1$, $2^{23}–1$, $2^{25}–1$ or $2^{28}–1$ (34 Mbit/s - 2852(S) & 2853(S))
$2^{15}–1$, $2^{18}–1$, $2^{20}–1$, $2^{23}–1$, $2^{25}–1$, $2^{28}–1$ or $2^{31}–1$ (34 & 140 Mbit/s - 2854S & 2855S)

PRBS sense can be true or inverted.

Octet bits in framed signals can be 7 data bits plus 1 fixed bit (7 + 1) or just 8 data bits (all 8). For '7 + 1', PRBS data fills the first 7 bits but the eighth bit is always a 1. The eighth bit is not used for any error measurement. For 'all 8', PRBS data fills all 8 bits in an octet.

PRBS limit sets the number of successive zeros per PRBS sequence to either 7, 14 or no limit at all (1544 kbit/s systems).

QRSS

A pseudo-random-bit-sequence signal with length $2^{20}–1$, zero limit 14 and sense true (1544 kbit/s systems).

Repword (Repetitive word)

The receiver synchronizes (and re-synchronizes) to any repetitive 16 bit word and also to 8, 24 bit words - 34 and 140 Mbit/s only. The displayed pattern is the detected received pattern.

Voice (external)

Decodes a 64 kbit/s encoded analogue signal present in the selected framed single channel of the received digital signal for output via the VF connector or via the internal loudspeaker (1544 and 2048 kbit/s systems). In additon, the signal level is measured and displayed (dBm0).

Note **Speaker on/off keyboard shortcut is [SHIFT] + [S] key.**

Data

Extracts a 64 kbit/s data signal present in the selected framed single channel of the received digital signal for output. The data output can be selected to be codirectional, contradirectional or DSO encoded data via the 64 kbit/s connector or NRZ data via the AUX connector. X.21, V.35 or RS-449 options are also available when the appropriate data cable is connected.

The Timing parameter controls where the 64 kbit/s clock is sourced from (Tx or Rx). When set to FROM TX, the 64 kbit/s clock is derived from the outgoing PCM signal (e.g. 2M) and provided to the external 64 kbit/s receiver as the clock source. When set to FROM RX, the 64 kbit/s clock is derived from the incoming PCM signal (e.g. 2M).

As a result, FROM TX is only available when the Tx is transmitting a PCM signal with 64 kbit/s content, and FROM RX is only available when the Rx is receiving a PCM signal with 64 kbit/s content.

Live (traffic)

During a test the receiver can detect errors in line code, frame, CRC, alarm and overhead bits of a digital signal containing live data. It is advisable to select *[Live]* if the received pattern is not compatible with 2851 patterns otherwise a permanent pattern alarm is generated.

Carrying

The received test pattern is displayed as it is received in two 8-bit blocks or 8, 16, 24 bit blocks for *[repword]*.

RX-N×64 channels

This mode is similar to the Framed Single Channel except that pattern data is distributed amongst the N selected 64 kbit/s channels. It is only available on systems with bit rates up to and including 2M (2048 kbit/s) excluding systems with robbed bit signalling.

Test Mode must be set to N×64 before this page can be accessed.

All channels available for selection are displayed and those currently selected are shown in reverse video.

Channel selection

Two modes of selecting the N×64 channels are available - GROUP or CURSOR (selected by right hand soft key).

In GROUP mode the channels are selected by pressing the *[SET N]* or *[RESET N]* softkey and then entering the list of channels to set or reset. The list can be a single channel, a series of channels, a group of channels or any combination of these, e.g.

Single channel :		= channel 1 only
Series of channels :	1.3.5	= channels 1, 3 and 5
Group of channels :	1-5	= channels 1 to 5 inclusive
Combination :	1.3.5-8	= channels 1, 3 and 5 to 8

In CURSOR mode, position the flashing cursor on the channel required and press *[SET]* or *[RESET]*. This mode affects only the particular channel selected.

Both modes of operation allow a CLEAR facility to clear all selected channels from the list and a COPY (Rx→Tx) facility to copy the current N×64 selection to the TX selection. Both of these facilities prompt the user for confirmation.

RX-overhead bits

The 2851 monitors the received digital signal and displays the current overhead bit status. Refer to the 'Bit Monitoring' section of the appropriate framing system in Appendix C for details of overhead bits monitored.

The Demux overhead bits page is accessed by pressing *[NEXT]* soft key.

RX-alarms

With Demux control set to ON, the hierarchical alarms are indicated by '<<'. For 2852(S) & 2853(S) Option 14 they are 34 M, 8 M and 2 Mbit/s. For 2854S & 2855S they are 140 M, 34 M, 8 M and 2 Mbit/s.

Alarms are also indicated on the front panel as LINE, ERRORS, PATTERN etc..

RX-signalling monitor

In this page select mode - Single channel or All channels or DTMF or Framed C-Bit.

For Single channel select the channel and the present and previous signalling codes and the dialling sequence are monitored.

For All channels all the present signalling codes are monitored. Select the signalling code for the other (idle) channels.

For DTMF select the channel and the dialling sequence is monitored.

For Framed C-Bit enter the channel and the present and previous signalling codes are monitored and also the C-Bit sequence.

Single channel monitor mode

Select the signalling channel to be monitored.

Signalling code

The present signalling code and the last signalling code received are displayed in binary and decimal. The signalling code can be either 2 or 4-Bits depending on the system.

Dialling sequence

If the Pulse break and Inter-pulse break signalling codes have been defined in the CONFIGURE-SIGNALLING page, the digits detected in a dialling sequence will be displayed in a string as they are received.

An error detected in a dialling sequence is displayed as a code below an 'X' character in the dialled digits string. When an error is detected the receiver stops monitoring but recommences after an inter-digit pause period occurs. All the digits (and any error codes) are cleared from the display when another dialling sequence is detected after a clear 10 second interval.

With the exception of Error Code 6 an error condition is caused by a time limit in the dialling sequence being outside that specified in the CONFIGURE-SIGNALLING page. The error codes are listed below:-

Dialling error code	Meaning
1	Wrong code
2	Short Pulse break
3	Long Pulse break
4	Short Inter-pulse break
5	Short Inter-digit pause
6	Excess digits

Wrong code:	A valid code was detected (for a period less than the Hang-up period, see below) which was not a Pulse break or Inter-pulse break code.
Short pulse break:	A Pulse break was detected for a period which was less than the minimum Pulse break period.
Long pulse break:	A Pulse break was detected for a period greater than the maximum Pulse break period (but less than the Hang-up period, see below).
Short Inter-pulse break:	An Inter-pulse break period was detected which was less than the minimum Inter-pulse break period.
Short Inter-digit pause:	An Inter-pulse break code was detected with a period greater than the maximum Inter-pulse break period but less than the minimum Inter-digit pause period.
Excess digits:	A dialling sequence had more than ten transitions of Pulse break and Inter-pulse break codes.

Hang-up (Line Free) conditions

The signalling channel can 'hang-up' if either of the following conditions occur:-

A Pulse break continues for 200 milliseconds more than the pulse break maximum period.

A wrong code condition continues for 200 milliseconds more than the pulse break maximum period.

Both conditions display a character 'F' (indicating Line Free) in the dialled digits string with no error code. When a 'hang-up' condition occurs, the receiver stops monitoring but recommences after an inter-digit pause period occurs. The dialled digits, error codes and character 'F' are cleared from the display when another dialled digit is detected.

All channels monitor mode

The signalling codes for all channels (1 to 30 - 2048 kbit/s or 1 to 24 - 1544 kbit/s) are displayed in binary unless the code matches a pre-defined idle code in which case IDLE is displayed.

To specify the idle code:

select *[IDLE]* and enter the new binary value.

To return to single channel monitoring select *[SINGLE]*.

DTMF monitor mode

Select the data channel to be monitored.

Note

DTMF uses the same channel as the Test Pattern and changes to the channel on the DTMF page affects the channel which is to receive the Test Pattern.

The digits detected in a dialling sequence are displayed in a string as they are received.

All the digits are cleared from the display when another dialling sequence is detected after a clear 10 second interval.

Framed C-Bit

In this mode the normal monitoring of the active channel signalling code is extended to include monitoring of the dedicated 15 bit sequence which replaces the normal C-bit within the signalling bits ABCD.

Select the signalling channel to be monitored.
The present signalling code and the last signalling code received are displayed and also the received C-bit sequence.
The first bit serves as the framing bit and follows a fixed sequence itself. The other 14 bits are used for dedicated flags as follows:

bit 2	"Escape"	bit 9	"Fault"
bit 3	"HDB3 Loopback Address"	bit 10	"Local Fault"
bit 4	"Loopback Source"	bit 11	"Remote Fault"
bit 5	"Loopback 2"	bit 12	"Subscriber Power Fault"
bit 6	"Loopback 3"	bit 13	"Subscriber Unavailable"
bit 7	"HDB3 Loopback"	bit 14	"Reserved"
bit 8	"ARC Loopback"	bit 15	"Reserved"

These descriptions are available to the user by highlighting the bit number on the page and entering the appropriate number.

Note that there is no decimal equivalent for the code in the active channel as the C-bit is undefined (shown by the binary digit being replaced by the character C) and the channel number also has the corresponding timeslot shown. Channels 1 to 15 associate to timeslots 1 to 15 but channels 16 to 30 associate to timeslots 17 to 31.

When the C-bit framing is incorrect the top line message *C-BIT:UNSYNC* is displayed.

RX-line level, frequency

The amplitude and frequency of the incoming digital signal is displayed. This enables early warning of degradation of the signal.

Rx input and line level

Select for Rx input: *[BAL]* or *[UNBAL]*.

Line level in Volts is displayed and also in dB relative to the nominal voltage of the input digital signal.

Frequency

The measured received bit rate (Frequency) and its Offset from the expected bit rate as determined by the selected Rx system is displayed.

Demux frequency and justification

With Rx Demux set to ON a second page is available as indicated by *more...* in the display field and *[NEXT]* as a new option. Press *[NEXT]* and the measured frequencies, offsets and justification ratios at the various levels through the Demux are displayed.

Press *[NEXT]* again to return to the first page.

RX-ISDN error report bits

2M/CnoMF systems

Error report bits to CCITT Rec G.96Y.

Bits 4, 5, 6, 7 & 8 in the Not Frame word are monitored.

The error alarm pulses (bits 4, 5, 6, 7 & 8) for the CRC multiframe inframe pairs 1/9, 3/11, 5/13, 7/15, are detected and displayed. Under these are displayed the corresponding point in the network at which detection occurred CD ->LT, NT1->LT, LT->NT1, NT2->NT1 and the error alarm pulses within bits 6, 7 & 8 corresponding to severely errored seconds (S), degraded minutes (D) and errored seconds (E).

2M/noMF systems.

Bits 4, 5, 6, 7 & 8 in the Not Frame word are monitored.

The four values (00, 01, 10, 11) for bits 4 and 5 are displayed along with the detected error alarm pulses within bits 6, 7 & 8 corresponding to severely errored seconds (S), degraded minutes (D) and errored seconds (E). Above these are displayed the corresponding point in the network at which detection occurred, CD ->ET, NT1->LT, LT->NT1, NT2->NT1.

RX-network propagation delay

The delay is measured using a PRBS unframed test pattern. Range and measurement repetition rate depends on the selected PRBS. For example at 2 Mbit/s using 2^{20} PRBS the delay range is approximately 0.5 s with an update rate of typically 2 s.

The following table shows examples of maximum delay measurements possible when using certain combinations of PRBS and bit rates. They are provided only as a guide as other combinations can be used to provide greater or lesser maximum delays as required.

Table 1 Propagation delay measurements - PRBS and bitrate combinations

← 2850B(s) & 2851s → (2^9 to 2^{20})

←—2852(s) & 2853(s) → (2^9 to 2^{28})

←—2854s & 2855s → (2^9 to 2^{31})

Bit rate \ PRBS	2^9	2^{11}	2^{15}	2^{20}	2^{23}	2^{25}	2^{28}	2^{31}
50	10.2s							
2400		0.8s	13.7s					
19.2k			1.7s					
64k			0.5s	16s				
704k				1.5s				
2M				0.5s				
8 M				0.12s				
34 M						1.0s	8.0s	
140 M						0.2s	1.9s	

Press *[EXECUTE]* to start the measurement and message *NPD RUNNING* is displayed.

Press *[STOP]* to terminate the measurement and delay is displayed in

bits and µs for system bit rates 100 kbit/s or over
bits and ms for system bit rates 100 bit/s or over
bits and s for system bit rates below 100 bit/s

If Rx and Tx settings are not compatible for this measurement then measurement is inhibited and the message *Change not allowed in this configuration* is displayed.

RX-demux control

Select the Demux function (ON or OFF) and select input and output tributary level - From and To field.

Having set the output tributary level to 34, 8 or 2 Mbit/s, the signal monitored within the selected tributary can be set using the RX-MENU System and other pages, and can be any of the 34 M Unframed or 8 M or 2 M systems normally available. For example if a 2 Mbit/s system is selected, the test signal can be Unframed or a 64 kbit/s or N×64 kbit/s test pattern. Equally if an 8 Mbit/s system is selected the test signals can be Unframed or for example a 64 kbit/s test pattern within a G.744 system. Other parameters can also be monitored in the selected tributary such as overhead bits and signalling.

Tributary selection is made using the tributary selection fields as appropriate. Input can be set to TERMINATED or MONITOR points with nominal attenuations of 20 and 30 dB for 140, 34 or 8 Mbit/s inputs.

Data transmitter pages

```
TX-DATA MENU

1 Summary          4 Error Injection
2 Clocks           5 Control Lines (TX & RX)
3 Pattern



   Mode
```

Note **Tx system cannot be changed when Tx is on.**

When the Tx system is changed or if the same Tx system is re-selected, certain default conditions are set, (see Appendix A).

TX-summary

Displays a summary of transmitter functions selected. All of these functions except Data system and Test mode can be selected in the other Tx pages but can also be changed in this page if required.

Transmitter on/off (Keyboard shortcut is [SHIFT] + [T] key).
Data system
Test mode (sync or async)
Clocks (sync) or Coding (async)
Bit rate
Carrying (test pattern)

System

In this page select the data system:

RS-232 DTE or DCE, Codirectional, Contradirectional, RS-449 (V.10) DTE or DCE, RS-449 (V.11) DTE or DCE, X.21 (V.10) DTE or DCE, X.21 (V.11) DTE or DCE, V.35 DTE or DCE, or TTL or Eurocom (D/1 IB6, see below).

Note **Before using the RS-232 DCE system ensure that the RS-232 DCE adapter lead is fitted.**

Eurocom D/1 IB6 system

With Option 22 or 25 fitted the Eurocom D/1 IB6 system is available for selection as EUROCOM. In addition when EUROCOM is selected the Eurocom signal can be selected as the Tx clock source, see Tx-clocks section below.

Test mode

This is sync or async for RS-232 and RS-449, sync for X.21 and V.35 or unstructured for codirectional, contradirectional, Eurocom and TTL.

Code

For X.21, RS-449 and TTL systems the line code can be selected from:

NRZ		
Biphase (Mark)	-	B/P (M)
Biphase (Space)	-	B/P (S)

For all other data systems the line code is forced to NRZ.

Tx-clocks

The transmitter uses a clock signal to transmit a data signal. The clock signal may be derived from one of the following sources.

Internal	-	Clock signal generated by the frequency synthesiser within the 2851.
External	-	Clock signal from an external source (via BNC CLOCK IN connector).
Receiver	-	Clock signal derived from the received digital signal.
External TTL	-	A DC coupled (gapped) clock signal from an external source (via AUX connector, see Chapter 2).
External 2 M (x32)	-	Signal from an external 2048 kbit/s source (via BNC CLOCK IN connector). Signal is divided down internally to 32 times the transmit bit rate and used as clock signal.
Contra	-	Clock signal derived from the contradirectional input (via 64 kbit/s connector, see Chapter 2).
Eurocom (D/1 IB6)	-	Clock signal derived from the European signal input (via 64kbit/s connector, see chap. 2).

The clock sense options are True or Invert.

Bit rate

The bit rate for the internal clock can be User selected or one of a soft key list.

TX-async coding

In this page select:

Data bits	5, 6, 7 or 8
Parity	None, Odd, Even
Stop bits	1, 1.5 or 2
Character rate	Low, Medium or High

TX-pattern

In this page select: Carrying, length and sense.

Carrying

PRBS, 16 BIT WORD, Messages FOX 1 - FOX 2 - FOX 3 or USER MESSAGE (up to 19 characters), Data sequences ALL 1's - ALL 0's - ALT 10's and two 8-BIT WORDS.

PRBS length can be set to $2^9–1$, $2^{11}–1$, $2^{15}–1$, $2^{20}–1$ and sense to True or Invert.

16-BIT WORD is a 16 bit binary word with soft keys allowing individual bits to be set by the user as ones or zeros.

Two 8-BIT WORDS are two programmable 8 bit sequences alternated by an external TTL input signal. The changeover occurs at the end of 8 bits. Soft keys allow the user to set individual bits as ones or zeros.

TX-error injection

In this page select:

Error mode (Manual or Rate).
Target bits
Error type

Injection:

Enable or disable error injection.

Note **Error injection enabled/disabled keyboard shortcut is [SHIFT] + [E] key.**

Mode

Manual: Inject single errors by pressing the [INJECT] key.

Rate: Injects single errors automatically at a rate in the range 1×10^{-7} to 3×10^{-1}.

Target bits

Pattern: Inverts test pattern bits.

Inject

Bit errors: A binary digit which is inverted before the bit stream is encoded.

TX/RX-control lines

This page displays the status of the control lines for the selected system as shown below and allows the TX line status to be changed.

	RS-232		RS-449		X.21		V.35	
DTE:	TX	RX	TX	RX	TX	RX	TX	RX
DCE:	RX	TX	RX	TX	RX	TX	RX	TX
	RTS	CTS	RS	CS	C	I	RTS	CTS
	DTR	DSR						
	RL	RLSD						
	LL	TM						

Highlight the required control line and press *[OFF]* or *[ON]* as appropriate.

Also in this page the time intervals (delay) between changes of the following control lines (DTE systems only) can be measured and displayed:

RS-232 RTS & CTS, RS-449 RS & CS, X.21 C & I, V.35 RTS & CTS.

Highlight READY and press *[EXECUTE]*.

EXECUTING is displayed and the control line is changed. Measurement is made of the time delay on the received control line change and this is displayed in ms up to a maximum of 10000ms. There is a measurement timeout period of 10 seconds after which measurement is stopped and 10000ms is displayed.

To cancel the measurement operation press *[STOP]*.

Remote loop activation and deactivation is provided for the RS-232 test interface by means of control lines RL and LL.

Data receiver pages

```
RX-DATA MENU

1 System
2 Coding
3 Pattern
4 Control Lines (TX & RX)
5 Network Prop. Delay
  Mode
```

Note **Certain Rx parameter options cannot be changed while a test is running.**

When the Rx system is changed or if the same Rx system is re-selected, certain default conditions are set, (see Appendix A).

RX-system

In this page the measured received bit rate (Frequency) and its offset from the expected bit rate as determined by the selected Rx system is displayed.

Select: Rx system
Test mode
Clock
Bit rate

System

In this page select the data system:

RS-232 DTE or DCE, codirectional, contradirectional, RS-449 (V.10) DTE or DCE, RS-449 (V.11) DTE or DCE, X.21 (V.10) DTE or DCE, X.21 (V.11) DTE or DCE, V.35 DTE or DCE or Eurocom (Option 22) or TTL or TTL or Eurocom (D/1 IB6, see below).

Note **Before using the RS-232 DCE system ensure that the RS-232 DCE adapter lead is fitted.**

Eurocom D/1 IB6 system

With Option 22 or 25 fitted the Eurocom D/1 IB6 system is available for selection as EUROCOM. In addition when EUROCOM is selected the Eurocom signal can be selected as the Rx clock source, see clock section below.

Input mode

For V.11 systems, user can select TERMINATED or UNTERMINATED.

For all other data systems input mode is forced to UNTERMINATED.

Test mode

This is sync or async for RS-232 and RS-449, sync for X.21 and V.35 or unstructured for Codirectional, Contradirectional, Eurocom and TTL.

Code

For X.21, RS-449 and TTL systems the line code can be selected from:

NRZ
Biphase (Mark) - B/P (M)
Biphase (Space) - B/P (S)

For all other data systems the line code is forced to NRZ.

Clock

The receiver uses a clock signal to receive a data signal. The clock signal may be derived from one of the following sources:

DCE - Clock signal from the data communication equipment.

DTE - Clock signal from the data terminal equipment.

External - Clock signal from an external source (via BNC CLOCK IN connector).

Rx Signal - Clock signal derived from the received digital signal.

TX - Clock signal derived from the transmitted signal.

Contra - Clock signal derived from the contradirectional input (via 64 kbit/s connector, see Chapter 2).

Eurocom (D/1 IB6) - Clock signal derived from the Eurocom signal input (via 64 kbit/s connector, see Chapter 2).

The clock sense options are True or Invert.

Bit rate

The bit rate for the RX system can be user selected or selected to be one of the rates displayed by the soft keys.

RX-async coding

In this page select:

Data bits	5, 6, 7 or 8
Parity	None, Odd or Even
Stop bits	1, 1.5 or 2

RX-pattern

In this page select for Carrying the expected test pattern.

Carrying

PRBS, 16 BIT WORD, Messages FOX 1 - FOX 2 - FOX 3
or enter USER MESSAGE (up to 19 characters).

PRBS length can be set to $2^9{-}1$, $2^{11}{-}1$, $2^{15}{-}1$, $2^{20}{-}1$ and sense to True or Invert.

The received test pattern is displayed as it is received in two 8-bit blocks.

TX/RX-control lines

This page displays the status of the control lines for the selected system as shown below and allows the TX line status to be changed.

	RS-232		RS-449		X.21		V.35	
DTE:	TX	RX	TX	RX	TX	RX	TX	RX
DCE:	RX	TX	RX	TX	RX	TX	RX	TX
	RTS	CTS	RS	CS	C	I	RTS	CTS
	DTR	DSR						
	RL	RLSD						
	LL	TM						

Highlight the required control line and press *[OFF]* or *[ON]* as appropriate.

Also in this page the time intervals (delay) between changes of the following control lines (DTE systems only) can be measured and displayed:

RS-232 RTS & CTS, RS-449 RS & CS, X.21 C & I, V.35 RTS & CTS.

Highlight READY and press *[EXECUTE]*.

EXECUTING is displayed and the control line is changed. Measurement is made of the time delay on the received control line change and this is displayed in ms up to a maximum of 10000ms. There is a measurement timeout period of 10 seconds after which measurement is stopped and 10000ms is displayed.

To cancel the measurement operation press *[STOP]*.

Remote loop activation and deactivation is provided for the RS-232 test interface by means of control lines RL and LL.

RX-network propagation delay

The delay is measured using a PRBS unframed test pattern. Range and measurement repetition rate depends on the selected PRBS. For example at 64 kbit/s using 2^{15} PRBS the delay range is approximately 0.5 s with an update rate of typically 2 s.

Press *[EXECUTE]* to start the measurement and message *NPD RUNNING* is displayed.

Press *[STOP]* to terminate the measurement and delay is displayed in
bits and μs for system bit rates 100 kbit/s or over
bits and ms for system bit rates 100 bit/s or over
bits and s for system bit rates below 100 bit/s

If Rx and Tx settings are not compatible for this measurement then measurement is inhibited and the message *Change not allowed in this configuration* is displayed.

Structured Data transmitter pages (Option 24)

```
TX-SDATA MENU

1 Summary          5 Data Rate
2 Clock            6 Error Injection
3 Pattern          7 Status
4 Bits             8 AIS, Levels

   Mode
```

Note **The Transmitter operates independently of the Receiver.**

TX-summary

This page displays a summary of transmitter functions already selected and enables them to be changed.

Interface
Line code
Structure
D & I (Drop & Insert)
Bit rate

Interface

Select the interface from:

Binary TTL
Balanced V.11
Balanced 120 Ω
PCM channel (see PCM+Structured Data section)

Line code

Select from NRZ, codirectional, contradirectional, AMI 50%, AMI 100 %, Biphase mark and Biphase space (as offered for the chosen interface).

Structure

Select the structure to be:

X.50 80 channel or X.50 20 channel

For 80 channel a frame comprises 5 phases where each phase carries 16 x 8-bit bytes. For 20 channel a frame comprises 5 phases where each phase carries 4 x 8-bit bytes. Each byte comprises a frame alignment bit, a status bit and 6 data bits.

Unstructured

Data is transmitted as a continuous sequence of data bits.

Structured 7 bit or 8 bit reiteration and 6+2

The signal is arranged in 8 bit bytes each of which comprises 6 data bits, 1 frame alignment bit and 1 status bit.

For sub-rates of 0.6, 1.2, 2.4, 4.8, 9.6 and 19.2 kbit/s the envelopes are reiterated the appropriate number of times to bring the aggregate rate to 64 kbit/s.

For 7 bit structure the framing bit is alternated in successive envelopes irrespective of new or reiterated data content.
For 8 bit structure the whole envelope is reiterated.

For 6+2 structure the envelope is not reiterated.

D & I (Drop and Insert)

When X.50 80 channel or 20 channel structure is selected the D & I mode of operation is available.

When D & I is set to ON select the Interface (.. In) and Line Code (..In) for the D & I receiver interface.

An X.50 80 channel or 20 channel structured signal can be applied to the transmitter, a channel selected, its data "dropped out" and a test pattern inserted.

Bit rate

The internally generated bit rate can be user selected over the range 32 kbit/s to 150 kbit/s with a resolution of one bit.
If the selected structure is X.50 or 7 or 8 bit reiteration the bit rate is forced to 64 kbit/s.

TX-clock

Clock source

The transmitter uses a clock signal to transmit a digital signal. The clock signal may be derived from one of the following sources:

Internal - Variable or fixed clock signal generated within the 2851.

TTL - TTL clock signal from an external source (via TTL connector, see Chap. 2). Select polarity to be True or Invert.

V.11 - Balanced V.11 clock signal from an external source (via V.11 connector, see Chap. 2). Select polarity to be True or Invert.

120R - 120 Ω balanced clock signal from an external source (via BAL 120 connector, see Chap. 2). Select polarity to be True or Invert.

Contra - Balanced contradirectional timing signal (with or without violations) from an external source (via BAL 120 connector, see Chap. 2).

Receiver - Clock signal derived from the received digital signal. Select polarity to be True or Invert.

TTL x 16 - TTL clock signal at 16 times the transmit bit rate from an external source (via TTL connector, see Chap. 2).

V11 2M - Balanced V.11 clock signal at a bit rate of 2048 kbit/s from an external source (via V.11 connector, see Chap. 2).

120R 2M - Balanced 120 Ω clock signal at a bit rate of 2048 kbit/s from an external source (via BAL 120 connector, see Chap. 2).

Signal - Clock signal derived from the received D & I signal.

Clock output

One of the following timing signals can be selected as the clock output:

None.

TTL - TTL square wave of fundamental frequency equal to the system bit rate of the binary data signal. The rising edge of the timing signal coincides with the centre of the data bit. Select polarity to be True or Invert. (Output via TTL connector, see Chap. 2).

V.11 - V.11 balanced timing signal at the system bit rate. Select polarity to be True or Invert. (Output via V.11 connector, see Chap. 2).

120R - 120 Ω balanced timing signal at the system bit rate. Select polarity to be True or Invert. (Output via BAL 120 connector, see Chap. 2).

Contra- Balanced timing signal at 64 kbit/s conforming to CCITT G.703. The duration of each timing pulse is 50% of the data bit length irrespective of mark or space. A timing violation occurs every 8th data bit. (Output via BAL 120 connector, see Chap. 2).

Alignment lock ON/OFF

The transmitted signal will be byte synchronised to the externally applied clock or data source containing violations or to the PCM channel.

When receiving data, (D & I) alignment lock ON uses the violations or PCM channel to fix the position of framing status and pattern.

TX-pattern

In this page select Carrying (test pattern) and the fill pattern.

Carrying

Select the test pattern from:

ALL 1's, ALL 0's, ALT 10, PRBS, WORD 12, WORD 16 or WORD N.

ALL 1

Continuous data sequence of 111 etc.

ALL 0

Continuous data sequence of 000 etc.

ALT 10

Alternating sequence of 1010

PRBS

PRBS is a pseudo-random-bit-sequence signal specified by length, sense, octet bits and depending on system, limit.

PRBS length can be set in the range 2^6-1 to 2^{32}-1 and sense to True or Invert.

WORD 12 or WORD 16

These are 12 bit or 16 bit binary words with individual bits (..Word Value) set by the user as ones or zeros. WORD 12 is used with 6+2 type structures and WORD 16 is used with unstructured data.

WORD N

The user can select the number of bits (3 to 24) for a binary word and set the individual bits as ones or zeros.

Fill pattern & Fill Status

The unused channels of the transmitted X.50 structured signal can be filled with ALL 1's, ALL 0's or a PRBS 2^7-1 pattern. The status bit can be set to 1 or 0.

TX-bits

This page allows the status bit to be set.
For X.50 operation this page allows selection of the status mode and the setting of the status bits, the Distant Alarm bit and the housekeeping bits.

Status mode and bit

For 7 or 8 bit structure the status bit can be set to 1 or 0.

For X.50 operation the status mode can be set as UNFRAMED, FRAMED and COMMAND or RESPONSE which are subsets of FRAMED.

UNFRAMED

Allows the status bit to be set to 1 or 0.

FRAMED

Allows the 7 status bit to be individually set to 1 or 0. They are displayed under their status bit designator.

COMMAND & RESPONSE

Allows selection of the following specific commands and responses:

Command Observation, Loopback 2, Loopback 3

Response Normal, Unavailable, Equipment Fault, Loopback, Line Fault.

Their status bits are displayed under the status bit designators.

Distant (A) bit

For X.50 operation the alignment bit in the first byte in a frame is replaced by a distant alarm bit designated A. This can be set to 1 or 0 (Alarm).

Housekeeping (B-H) bits

For X.50 80 channel operation the alignment bit in every 10th byte (excluding the first byte) in a frame is replaced by a Housekeeping bit designated B to H. Each bit can be set to 1 or 0.

TX-data rate

The data rate for structured data can be selected by the soft keys.
In addition the X.50 data rate can be user defined
For X.50 operation the channel or channel pairs can be selected.

TX-error injection

Errors can be injected manually or automatically at a specified rate.

Select Enable or Disable error injection.

Note **Error injection enabled/disabled keyboard shortcut is [SHIFT] + [E] key.**

Error injection rate

Select Manual - Inject single errors by pressing the [INJECT] key.

Select Rate - Select from the rates displayed on the soft keys. Single errors are automatically injected at the selected rate in the range 1 x 10^{-2} to 1 x 10^{-8}.

Target bits

Pattern - Inverts test pattern bits (not alignment bits or status bits of structured signals).
Framing - Inverts framing bits within the framing pattern of the X.50 generated signal (not housekeeping bits).
Envelope - Inverts bits within the envelope comprising pattern data, alignment and status bits.
Bit - Inverts a user specified bit within the user defined 12 bit or 16 bit word.

TX-status

Displays the transmitter status for Clock signal and Drop & Insert operation.

Clock signal

Absent or present

Drop & Insert

Data Input - X.50 data is absent or present

Synchronisation - Framing synchronization from the X.50 data has been lost or achieved.

TX-AIS, levels

AIS

Allows manual injection of an Alarm Indication Signal simulated by an unframed burst of all 1's.
When selected displays *EXECUTING* until AIS burst length expires or *[STOP]* is pressed.
AIS length can be set in the range 0 to 99.99s.

Outputs level and Inputs threshold

The peak voltage of the output timing signal and the threshold voltage for the input signal can be set by the user within the range 0.10 V to 1.50 V with a resolution of 0.01 V. These selections are relevant for BAL-120 data or clock and are common to Rx and Tx.

Structured Data receiver pages (Option 24)

```
RX-SDATA MENU

1 System         5 Data Rate
2 Clock          6 Status
3 Test Pattern   7 Alarms
4 Bits           8 Levels

   Mode
```

Note **The Receiver operates independently of the Transmitter.**

RX-system

This page displays the measured bit rate (frequency) of the incoming digital signal and a summary of receiver functions already selected which can be changed. They are:

Interface
Line code
Structure
Bit rate

Interface

Select the interface from:

Binary TTL	
Balanced V.11 -	can be Terminated or Unterminated
Balanced 120 Ω -	can be Terminated or Unterminated
PCM channel	(see PCM+Structured Data section)

Line code

Select from NRZ, codirectional, contradirectional, AMI 50%, AMI 100 %, Biphase mark and Biphase space (as offered for the chosen interface).

Structure

Select the structure to be:

X.50 80 channel or X.50 20 channel

For 80 channel a frame comprises 5 phases where each phase carries 16 x 8-bit bytes.
For 20 channel a frame comprises 5 phases where each phase carries 4 x 8-bit bytes.
Each byte comprises a frame alignment bit, a status bit and 6 data bits.

Unstructured

Data is received as a continuous sequence of data bits.

Structured 7 bit or 8 bit reiteration and 6+2

The signal is received in 8 bit bytes each of which comprises 6 data bits, 1 frame alignment bit and 1 status bit.

For sub-rates of 0.6, 1.2, 2.4, 4.8, 9.6 and 19.2 kbit/s the received envelopes have been reiterated the appropriate number of times to bring the aggregate rate to 64 kbit/s.

7 bit structure is received with the framing bit alternated in successive envelopes irrespective of new or reiterated data content.
8 bit structure is received with the whole envelope reiterated.

6+2 structure is non-reiterated.

Bit rate

The bit rate for the receiver can be user selected over the range 32 kbit/s to 150 kbit/s with a resolution of one bit.

If selected Structure is X.50, 7 bit or 8 bit the bit rate is forced to 64 kbit/s.

RX-clock

Timing source

To correctly extract the data content of an incoming signal, the receiver synchronises to a timing signal which must be related to the data transitions. The timing signal may be derived from the following sources:

Internal Fixed clock signal generated within the 2851.

TTL - A TTL square wave from an external source at the received bit rate (via TTL connector, see Chap. 2). Select polarity to be True or Invert.

V.11 - A balanced V.11 timing signal from an external source at the received bit rate (via V.11 connector, see Chap. 2). Select polarity to be True or Invert.

120R - 120 Ω balanced timing signal from an external source at the received bit rate (via BAL 120 connector, see Chap. 2). Select polarity to be True or Invert.

Contra - A balanced bipolar contradirectional timing signal (with or without violations) at the received bit rate from an external source (via BAL 120 connector, see Chap. 2).

Receiver - The timing signal is derived from the received digital signal.

Timing output

One of the following timing signals can be selected as the clock output:

None.

TTL - TTL square wave of fundamental frequency equal to the system bit rate of the binary data signal. The rising edge of the timing signal coincides with the centre of the data bit. Select polarity to be True or Invert. (Output via TTL connector, see Chap. 2).

V.11 - V.11 balanced timing signal at the system bit rate. Select polarity to be True or Invert. (Output via V.11 connector, see Chap. 2).

120R - 120 Ω balanced timing signal at the system bit rate. Select polarity to be True or Invert. (Output via BAL 120 connector, see Chap. 2).

Contra- Balanced timing signal at BAL 120 conforming to CCITT G.703. The duration of each timing pulse is 50% of the data bit length irrespective of mark or space. (Output via BAL 120 connector, see Chap. 2).

Alignment lock ON/OFF

With Alignment lock OFF the receiver byte alignment or envelope alignment (6+2 structure) is adjusted until the received data matches the expected test pattern. With Alignment lock ON the byte alignment or status bit (6+2 type structure) is fixed by the position of the violations.

RX-test pattern

This page allows selection of the expected test pattern to which the receiver can synchronise. A further selection enables the receiver to learn the incoming unknown test pattern.

Sync to

Select the test pattern from:

LEARN, ALL 1's, ALL 0's, ALT 10, PRBS, WORD 12, WORD 16, WORD N and TRAFFIC.

LEARN

The receiver learns and sets to the incoming test pattern. This includes inverted PRBS and repetitive patterns. Message *LEARNING* is displayed during the learning operation and then the learned parameters - pattern, polarity and word value are displayed.

ALL 1

Continuous data sequence of 111 etc.

ALL 0

Continuous data sequence of 000 etc.

ALT 10

Alternating sequence of 1010

PRBS

PRBS is a pseudo-random-bit-sequence signal which can be used for unstructured or structured signals.

PRBS length can be set in the range 2^6-1 to 2^{32}-1 and sense to True or Invert.

WORD 12 or WORD 16

These are 12 bit or 16 bit binary words with individual bits (..Word Value) set by the user as ones or zeros.

WORD 12 is used with 6+2 structure and WORD 16 is used with unstructured data.

WORD N

The user can select the number of bits for a binary word (up to 24) and set the individual bits as ones or zeros.

TRAFFIC

The receiver monitors the alignment bits, status bits and housekeeping bits (if X.50) of structured signals containing "live" data or unknown test pattern data.
These are:

Structured 8 bit reiteration traffic
Structured 7 bit reiteration traffic
Structured 6+2 traffic
X.50 80 channel traffic
X.50 20 channel traffic

RX-bits

This page displays the monitored status bit for 7 or 8 bit structure.
For X.50 operation this page allows selection of the status mode and displays the monitored status bits, the Distant Alarm bit and the housekeeping bits.

Status mode and bit

For 7 or 8 bit structure the decoded status bit is displayed as 1 or 0.

For X.50 operation the status mode can be selected as UNFRAMED or FRAMED.

UNFRAMED

The received status bit is decoded and displayed as 1 or 0.

FRAMED

The received status bits are decoded and the recognised command or response type is displayed and also the 7 individual status bits under each status bit designator.

If frame sync is not achieved LOST is displayed.

If frame sync is achieved but the status bits are not recognised ACHIEVED is displayed.

Recognised commands and responses are as follows:

Command	Observation, Loopback 2, Loopback 3
Response	Normal, Unavailable, Equipment Fault, Loopback, Line Fault.

Distant (A) bit

For X.50 operation the received Distant Alarm bit A is displayed as 1 or 0. (0 is the Alarm state).

Housekeeping (B-H) bits

For X.50 80 channel operation the received housekeeping bits B to H are displayed as 1 or 0.

Housekeeping bits B to H replace the alignment bit in every 10th byte in a frame.

RX-data rate

The data rate for structured data can be selected by the soft keys.

In addition the X.50 data rate can be user defined.

Selecting LEARN soft key enables 2851 to learn the received data rate (not X.50). While the data rate is being learnt the message *LEARNING* is displayed and on completion the data rate is displayed.

For X.50 operation the channel or channel pairs can be selected.

RX-status

This page displays the status for the following signals and conditions.

Data signal	- Data signal is absent or present.
Timing signal	- Timing signal is absent or present.
Framing sync	- Frame alignment has been lost or achieved.
Frame status sync	- Framed status frame alignment has been lost or achieved.

Note that data signal (Pattern) and framing sync (Frame) alarm conditions - ABSENT or LOST are indicated on the front panel alarm LEDs. When in the PCM+SDATA mode they are also displayed on the RX-ALARMS page.

RX-alarms

In SDATA mode LINE, AIS, FRAME, DISTANT, PATTERN and ERRORS alarms are generated and indicated on the front panel LEDs.

When in the PCM+SDATA mode the above alarms are generated (except LINE) and are ORed with the PCM alarms to the LEDs. This page can then be used to identify the source of the multiple FRAME and DISTANT alarms.

RX-levels

The peak voltage of the output timing signal and the threshold votage for the input signal can be set by the user within the range 0.10 V to 1.50 V with a resolution of 0.01 V. These selections are relevant for BAL 120 data or clock and are common to Rx and Tx

PCM + Structured Data (Option 24)

Introduction

This mode of operation allows structured data to be generated and received as part of a PCM system signal.

Structured data can be transmitted and received as the test pattern in PCM single channel transmitter operation or it can be the replacement pattern for the PCM channel in transmitter D & I operation.

2851 is setup using a combination of the PCM and SDATA modes of operation.

The PCM+SD mode is first selected on the Tx and Rx menu pages. Menu display indicates 2851 is in this mode by displaying MODE, PCM and SDATA soft key options available, see display example below.

On entering the mode selections for Tx and Rx Test Mode, Structured Data pattern and PCM channel Interface are pre initialised ready for operation.

The few remaining selections necessary are then made (still in PCM+SD mode) on the appropriate PCM and SDATA Tx and Rx edit pages.

These edit pages are the same PCM and SDATA pages as described in detail in the previous PCM and SDATA sections and therefore the following descriptions are in a simplified form.

Tx selections

PCM+Structured Data mode *[PCM+SD]* is first selected from the TX MENU page.

Press the Tx MENU key.

If Tx is already in PCM+SD mode pressing the TX MENU key will display the PCM or SDATA menu page without the need for selection. See Tx display example below to identify when 2851 is in PCM+SD mode.

If Tx is not in PCM+SD mode press *[MODE]* on the TX MENU page and from the selection of soft key modes press *[PCM+SD]*.

Select the required system menu by pressing *[PCM]* or *[SDATA]*.

Example

```
TX-PCM MENU

1 Summary              6 Overhead Bits
2 Clock, AIS           7 Signalling
3 Pattern              8 Sequence Tests
4 Error Injection

   Mode      PCM      SDATA
```

Note that page title is TX-PCM MENU but PCM and SDATA mode soft key options are still displayed on the bottom line to indicate that the Tx is in the PCM+SDATA mode.

Setting TX for PCM signal with SDATA as test pattern

Select TX PCM+SD mode as described above.

> On entering PCM+SD mode the PCM Test Mode and Pattern are initialised to FRAMED SINGLE CHANNEL 1 carrying STRUCTURED DATA and the SDATA Interface is initialised to the PCM CHANNEL.

Changes if necessary to the PCM system (to D & I mode etc) and Structured Data parameters are made on the appropriate PCM and SDATA pages (still in the PCM+SD mode).

Rx selections

PCM+Structured Data mode *[PCM+SD]* is first selected from the RX MENU page.

Press the RX MENU key.

If Rx is already in PCM+SD mode pressing the RX MENU key will display the PCM or SDATA menu page without the need for selection. See Rx display example below to identify when 2851 is in PCM+SD mode.

If Rx is not in PCM+SD mode press *[MODE]* on the RX MENU page and from the selection of soft key modes press *[PCM+SD]*.

Select the required system menu by pressing *[PCM]* or *[SDATA]*.

Example

```
RX-PCM MENU

1 System             6 Signalling Monitor
2 Test Pattern       7 Line Level, Frequency

4 Overhead Bits

   Mode      PCM      SDATA
```

Note that page title is RX_PCM MENU but PCM and SDATA mode soft key options are still displayed on the bottom line to indicate that the Rx is in the PCM+SDATA mode.

Setting RX for PCM signal with SDATA as test pattern

Select RX PCM+SD mode as described above.

> On entering PCM+SD mode the PCM Test Mode and Pattern are initialised to FRAMED SINGLE CHANNEL 1 synchronised to STRUCTURED DATA and the SDATA Interface is initialised to the PCM CHANNEL.

Changes (if necessary) to the PCM system and Structured Data parameters are made on the appropriate PCM and SDATA pages (still in the PCM+SD mode).

Sub 64 kbits/s test patters

It is possible to transmit and receive test patterns in a 64 kbit/s channel, but using a subset of the 8 bits available. This allows the instrument to transmit and receive test patterns at multiples of 8 kbit/s (i.e. 8, 16, 24... 64 kbit/s).

This feature is accessed by setting the Tx (or Rx) to combined PCM and Structured Data mode (PCM + 5D) and selecting unstructured data (UNSTRUCT). This then inserts the 64 kbit/s unstructured data into a single PCM channel, or extracts it from the PCM channel in the case of the receiver. The selection of which 8 bits to use (Pattern mask) is then made from the TX-SUMMARY or RX-SYSTEM page, as appropriate.

The pattern generated is contiguous within the pattern bits selected, and the Tx and Rx pattern bits need not be the same (but will need to be the same number). This means that testing across systems with bit mapping is possible.

Test pages

```
TEST-MENU

1 Progress                  5 Loopback Setup
2 Parameters                6 Loopback Control
3 Stored G.821 Setup        7 Perf Limits
4 Stored G.821 Limits       8 Perf Thresholds
```

Pages 5 and 6 are only available when Structured Data option is fitted.

Test-progress

Displays date and time of events during a test:-

The Test Start Time year-month-day, hour:minute:second.

The Test Stop Time year-month-day, hour:minute:second.

The Terminate After Time in hours:minutes:seconds.

This is displayed instead of Test Stop Time if the test is still running.

The Measurement Time in days, hours:minutes:seconds. This is the time elapsed since the test started excluding any Power Loss periods.

Power Loss Time in days, hours:minutes:seconds. This is the total time elapsed for any power lost during the test.

Note **Terminate After Time includes the Measurement Time and the Power Loss Time.**

Test-parameters

In this page:-

Set Test termination.
Set Current Error Ratio Gating.
Set Major error type.
Set Error burst threshold.

Enable/Disable Buzzer. (Keyboard short cut is [SHIFT] + [B] key).

Note **Set test parameters before pressing the [START] key.**

Test termination

Set Test Termination to be either timed or indefinite.

If test is TIMED, enter the test duration in hours:minutes:seconds. Up to 99 hours 59 minutes and 59 seconds can be set but only the latest 72 hours will be recorded in non-volatile memory in the Results pages.

Current error ratio gating

Enter one of the fixed gating periods 1, 2, 5 or 10 seconds or select Auto which uses a fast attack/slow decay algorithm.

Major error type

Enter major error type to be monitored ie. line code, pattern, CRC, Frame Word (FW) (if system is frame word based), Frame Bit (FB) (if system is frame bit based).

For instruments with Mux/Demux facility and Demux ON, further selections of FW and FB for each level are available.

Note **Although 2MFB, 8MFB, 34MFW, 34MFB, 140 MFW & 140 MFB can be selected as the major error type they are not available as ERRORS OUT signal.**

2MFW & 8MFW are only available as ERRORS OUT signal if Demux = 2M or 8M respectively.

For instruments with Structured Data facility, major error types SData pattern and SData framing can be selected.

Error burst threshold

Enter error burst threshold i.e. the number of errors to qualify as a burst:- 8, 16, 32, 64, 128 or 256.

Note **Burst threshold can be changed when a test is running.**

Buzzer

Either disable buzzer or set it to buzz on either alarms or errors or both.

Note **Buzzer disabled/restored keyboard short cut is [SHIFT] + [B] key.**

Test-stored G.821 setup

Set the interval and number of intervals for stored G.821 measurement results which are displayed on the RESULTS-STORED G.821 pages.

Intervals can be set to 15 min, 30 min, 1 hour or 24 hours.

Number of intervals can be set to be between 1 and 100.

The stored intervals are aligned with real time interval boundaries : i.e. 1 day intervals change at midnight, 1 hour intervals change on the hour, 30 mins change on the hour and half past the hour, 15 mins change on the hour, quarter past, half past and quarter to the hour.

If the test duration is longer than the store length entered, the store will retain the most recent recorded intervals of measurement

Test-stored G.821 limits

Limit values (maximum acceptable values) for the stored G.821 measurement results are entered by selecting from the options:-

G.821 line lengths,
G.921 line lengths,
User 1
User 2

For G.821 and G.921 options the limit values are automatically calculated from the entered line lengths.

For User 1and User 2 options the limits are entered directly.

The range of selections permitted is as follows.

G.821 Selectable line lengths

Grade	Range	Range
Local	0 to 5000 km	
Medium	0 to 5000 km	Radio : 0 to 5000 km
High	0 to 50000 km	Radio : 0 to 50000 km

G.921 Selectable line lengths

Class	Line .... Block		Radio .... Block
1	0 to 50000 km	(0 to 179)	0 to 50000 km (0 to 179)
2	0 to 5000 km	(0 to 18)	0 to 5000 km (0 to 18)
3	0 to 2500 km	(0 to 50)	0 to 2500 km (0 to 50)
4	0 to 2500 km	(0 to 50)	0 to 2500 km (0 to 50)

Note **Corresponding block allocation number is automatically displayed in brackets.**

USER 1 User selectable limits for errors

DM interval	0 to 9999.999
ES interval	0 to 65000.000
SES interval	0 to 65000.000

USER 2 User selectable limits for errors

For each category of error (i.e. DM, ES and SES), the user specifies the objective as a percentage of the nominal G.821 limits (e.g. 10% for introduction into service, 50% for maintenance), and the allocation for the particular circuit under test (e.g. 5%). These figures are then used to calculate the overall limit for each category of error (DM, ES and SES).

			% Objective		% Allocation		%Total
DM interval	10.0	×	100.000	×	100.000	=	10.000000
ES interval	8.0	×	100.000	×	100.000	=	8.000000
SES interval	0.2	×	100.000	×	100.000	=	0.200000

Test-loopback setup

For instruments fitted with Structured Data facility.

Loopback testing is carried out using a single 2851. The remote line terminator equipment at one end of a channel is remotely controlled by the 2851 to return data transmitted by the 2851.

The parameters for loopback testing are set on this page. Testing can be carried out using any one of the TTL, V.11 or Bal 120 Ω interfaces.

Loop mode

The loopback mode can be selected from:

None
BT
SIP
DER
DER/SIP

BT

2851 activates a remote loop by sending a loop activation pattern. The standard BT loop activation pattern comprises alternating pairs of ones and zeros with status bit set to 0. The loopback pattern and status bit cannot be edited.

When the receiver recognises the returned loop characters the transmitter automatically replaces them with the actual test pattern.

The remote loop activation pattern status bit overrides the status bit set in the TX-BITS page.

SIP

2851 activates a remote loop by initially sending loop words. Each loop word is identical and comprises 1 framing bit, 6 data bits and a status bit. The status bit is always 0 and the framing bit will be according to the signal structure.

When the selected number of loop words have been sent, the transmitter sends the selected test pattern interleaved with the loop holding words.

The receiver synchronises to the framing bits, the loop words and the test pattern.

For SIP unstructured data the loop is activated by 2048 bits of a binary scrambled sequence followed by the unstructured loop word (comprising 8 bits) repeated 16 times.

DER

2851 sends a loop sequence pattern to establish a route through a sequence of up to 20 multipoint switches (DERs). The loop sequence pattern contains selected numbers/letters to define the connection (tributary) through each DER.

The receiver has confirmation that the correct routing has occurred when it receives the loop sequence pattern and the identification number for each called DER. Test pattern data is then transmitted along the DER route.

DER/SIP

This is a two mode operation consisting of DER mode followed by SIP mode.

DER Trib

Select the route through up to 20 multipoint switches (DER's) by selecting in turn each DER tributary defined in the range 1 to 9, 0, A or C.
0 = 10. A = prolonging channel. C = common channel.

Loop characters, Loop word

SIP mode.

The number of loop characters (loop words) initially transmitted in the loop activation sequence is user selectable from 1 to 255.

Any of the 6 data bits in the loop word can be set by the user to 0 or 1.

For SIP unstructured data any of the 8 data bits in the loopword can be set to 0 or 1.

Test-loopback control

This page allows control of the loop for loopback testing and displays the monitored loop status.

Loop control

Select from the soft keys to Activate or Deactivate the loop.

In DER mode alternative selections allow the connections to be manually stepped through. Press [NEXT DER] or [REPT DER] soft key to send the next tributary number or to send the last number again.

Pressing DEACTIVTE ends loop control but the selected test pattern transmission is maintained.

Loop Status

For BT and SIP mode the loop status is Inactive or Activating or Active.

Inactive - Indicates that loop-back testing is not in operation.

Activating - Displayed to indicate that the remote loop activation pattern has been transmitted but not yet returned.

Active - Indicates that the transmitted loop activation pattern has been returned and recognised by 2851. The transmitter is now sending the selected test pattern through the established loop.

DER Status

The DER status is Inactive or Activating or Active.

Inactive - Indicates that DER routing is not in operation.

Activating - Displayed to indicate that the Tributary pattern sequence is in the process of being sent or has been sent but not yet routed back. The identification number (..ID) of each routed DER is displayed as it is connected.

Active - Indicates that the routing of the pattern sequence through the deriving equipment has been confirmed by the 2851.

DER Progress

The tributary number for each DER is highlighted as it is connected.

TEST-performance limits

This page allows limit values to be set for either G.821, G.826 or M.2100 measurements. Limit activation is settable for each parameter.

G.821		G.826	
%ES	0 to 99.999	ESR	0 to 9.9E-9
%SES	0 to 99.999	SESR	0 to 9.9E-9
%DM	0 to 99.999	BBER	0 to 9.9E-9
%US	0 to 99.999	%US	0 to 9.9999

	M.2100 1st limit (S1)	M.2100 2nd limit (S2)
ES	0 to 9998	0 to 9999
SES	0 to 9998	0 to 9999
US	0 to 9998	0 to 9999

For G.826/M.2100, REI (E bits) are measured and contribute to SES if Forward Path is enabled.

TEST-performance thresholds

This page allows SES thresholds to be set for the following parameters for G.826/M.2100 measurements

Frame Error
CRC blocks
REI (E-bits)

Status page

PCM

```
STATUS                                     TX: MUX ON
TX: 34M          RX: 34M           Res: CODE
    2M               2M                 0E-0
    FRAMED           FRAMED             0
    PRBS             PRBS
                 Event Print          : OFF
Test:  INDEF     Interval Print       : OFF
```

DATA

```
STATUS
TX: 9.600        RX: 9.600         Res: CODE
    232 DTE          232 DTE            0E-0
    SYNC             SYNC               0
    PRBS             PRBS
                 Event Print          : OFF
Test:  INDEF     Interval Print       : OFF
```

Status

For PCM and Data modes this is a single monitor page, (see examples above). For SData and PCM+Data modes the status is displayed on two pages,, (see examples below).

Status information displayed is as follows:

For Transmitter & Receiver

PCM	- Mux/Demux status, system, test mode and pattern or
DATA	- Bit rate, system, test mode and pattern or
SDATA	- Interface, system and pattern
PCM+SData	- On PCM page the system, test mode and pattern
	- On SData page the system, bit rate, pattern and loopback status

Results for the selected major error type

The error type, error ratio, total errors

Test timing

Timed or Indefinite

Printing

Event Print ON/OFF
Interval Print ON/OFF

SData

```
STATUS
TX:              RX:                Res: CODE
                                         0E-0
                                         0

                 Event Print           : OFF
Test: INDEF      Interval Print        : OFF
  NEXT
```

Press *[NEXT]* to display Structured Data Status.

```
STATUS
TX:          RX:          Freq:0
X50 20       X50 20       Patt:0.0000E+000
48000        48000            0
2^15INVERT   2^15INVERT   Frm:0.0000E+000

Loopback : NONE (INACTIVE)
  NEXT
```

Press *[NEXT]* to return to PCM status.

PCM+SData

```
STATUS
TX:              RX:                Res: CODE
    2M               2M                  0E-0
    SINGLE           SINGLE              0
    SDATA            SDATA
                 Event Print           : OFF
Test: INDEF      Interval Print        : OFF
  NEXT
```

Press *[NEXT]* to display Structured Data status.

```
STATUS
TX:          RX:          Freq:0
X50 20       X50 20       Patt:0.0000E+000
48000        48000            0
2^15INVERT   2^15INVERT   Frm:0.0000E+000

Loopback : NONE (INACTIVE)
  NEXT
```

Press *[NEXT]* to return to PCM status.

Results pages

```
RESULTS-MENU

1 Major Errors          6 Demux Errors
2 Other Errors          7 Sync Status
3 Performance           8 Bursts
4 Stored Results        9 Octet Slips
5 Stored G.821          0 Sync Slips
```

* When Structured Data option is fitted, page 6 title is SDATA Errors.

Results are accumulated during a test and stored in non-volatile memory. The results are reset at the beginning of a test when the [START] key is pressed.

Results displayed on the RESULTS pages can be:

1. The current test results if a test is running or
2. The full test results from the last test run or
3. A set of recalled test results (identified by the message RECALLED TEST) as selected on the STORE/RECALL-TESTS page.

Timing details for the test are displayed on the TEST-PROGRESS page.

Note **Not all Results pages are relevant to every Receiver configuration.**

Results-major errors

Displays the major error type selected in the TEST-PARAMETERS page. Plus the measured total errors, long term mean error ratio, current error ratio and residual error ratio.

Results-other errors

Lists the error ratio and totalized number of errors detected during a test for the major error type and all of the other error types.

Results-performance (G.821, G.826, M.2100)

Displays the range of error performance measurements in accordance with G.821 (64 kbit/s systems) or G.821 Annex D (above 64 kbit/s), G.826 or M.2100 performed during a test on the received signal. The *[NEXT]* soft key is used to select the appropriate page. Percentage results for G.821 can be configured to indicate either 100% Good (desirable) results or 0% Good (desirable) results for the major error type selected in the TEST-PARAMETERS page. An appropriate message is displayed if a limit is exceeded (see 'TEST-performance limits').

G.821

Errored seconds
Severely errored seconds
Degraded minutes
Unavailable seconds
Number of breaks

100% = GOOD

Percentage error free seconds
Percentage non-severely errored seconds

Percentage non-degraded minutes
Percentage available seconds

0% = GOOD

Percentage errored seconds
Percentage severely errored seconds
Percentage degraded minutes
Percentage unavailable seconds

G.826

Applicable if Stored mode is PCM and Stored Test Mode is not Unframed.
Errored second ratio
Severely errored second ratio
Background block error ratio
Percentage unavailable seconds

M.2100

Errored seconds
Severely errored seconds
Unavailable seconds

Note **Definitions of performance data measurements are given in Chap. 1.**

Results-stored hours/stored minutes

(see Fig. 3-8)

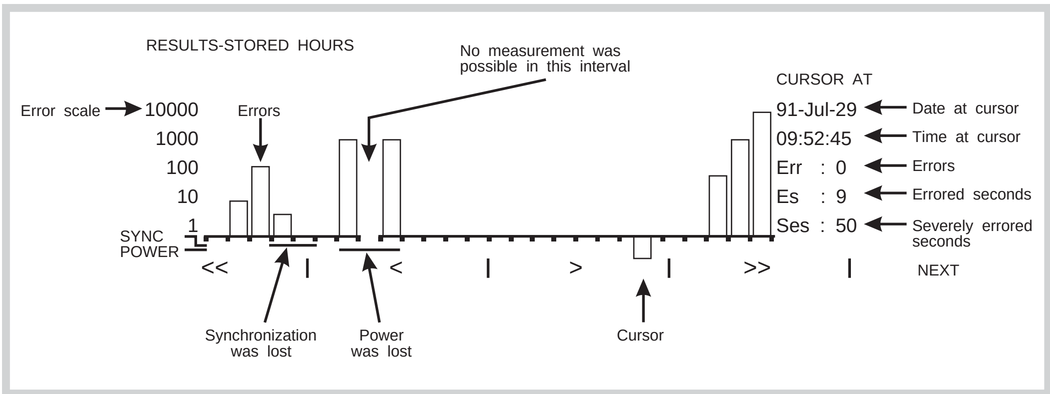


Fig. 3-8 Results - Stored Hours page

Two bar graph pages display a graphical presentation of the distribution of errors detected with time during a test. Errors can be recorded over a maximum of 72 hours and displayed either in an 'hours' page with a page width representing 20 hours or in a 'minutes' page with a page width representing 20 minutes. The graph height represents number of errors scaled in 1, 10, 100, 1000 and 10,000. The indicated errors will be for the major error type selected in the TEST-PARAMETERS page i.e. either line code, pattern, framing or CRC errors.

The bar graph display is stored in non-volatile memory until reset when the [START] key is pressed.

Cursor movement

Move the cursor along the horizontal axis by pressing the appropriate soft key below the display. *[<]* or *[>]* moves the cursor one minute/hour to the left or right respectively. *[<<]* or *[>>]*

moves the cursor 15 minutes/hours to the left or right respectively. The resolution is one hour in the 'hours' page and one minute in the 'minutes' page.

Display other hours or other minutes off-page

If the measurement duration exceeds the width of the minutes page or hours page i.e. 20 minutes or 20 hours respectively these minutes or hours will be stored off page.

To display earlier minutes or hours recorded off-page, move the cursor to the extreme left. Press the [<] soft key once to display the earlier minute/hour or press [<<] soft key once to display the earlier 15 minutes/hours. The earlier minutes/hours will move in from the left.

To display later minutes or hours recorded off-page, move the cursor to the extreme right. Press the [>] soft key once to display the later minute/hour or press [>>] soft key once to display the later 15 minutes/hours. The later minutes/hours will move in from the right.

Moving to hours or minutes page

To change the display page press the [NEXT] soft key.

On the Minutes page the period displayed is the first 20 minutes of the hour selected by the cursor on the Hours page.

'Sync' and 'power' markers

A loss of synchronization and power failure is recorded below the horizontal axis using markers on separate lines. Because the resolution of the display graphics are limited to one hour or one minute - depending on the page selected - a marker extends over the full hour or minute interval irrespective of the number of times synchronization was lost or power failed in that hour or minute. See Fig. 3-9.

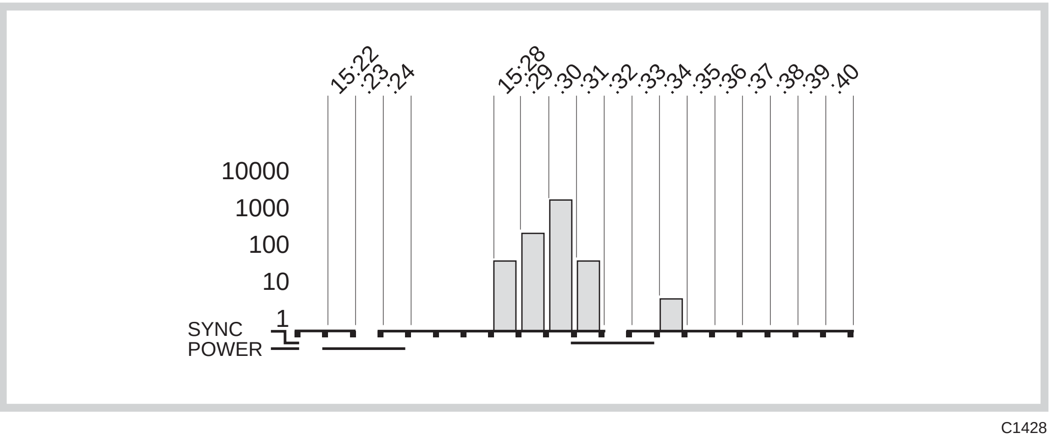


Fig. 3-9   Example of Results-Stored Minutes page

Fig. 3-9 shows power was lost at some time inside the 15:22 minute interval. The gap in the baseline indicates no measurement was possible for the full duration of 15:23 because power remained lost for the full duration of this interval. Power was restored and the measurement resumed at some time inside the minute interval of 15:24.

Fig. 3-9 also shows synchronization was lost at some time inside the 15:31 minute interval. The gap in the baseline indicates no measurement was possible for the full duration of 15:32. This was because synchronization remained lost for the full duration of 15:32.

In theory, sync could have been lost and regained any number of times inside the intervals 15:31, and 15:33 in the example shown in Fig. 3-9.

Sync was gained and the measurement resumed at some time inside the minute interval of 15:33 and continued into 15:40. Events after 15:40 would be recorded off page.

Results-stored G.821

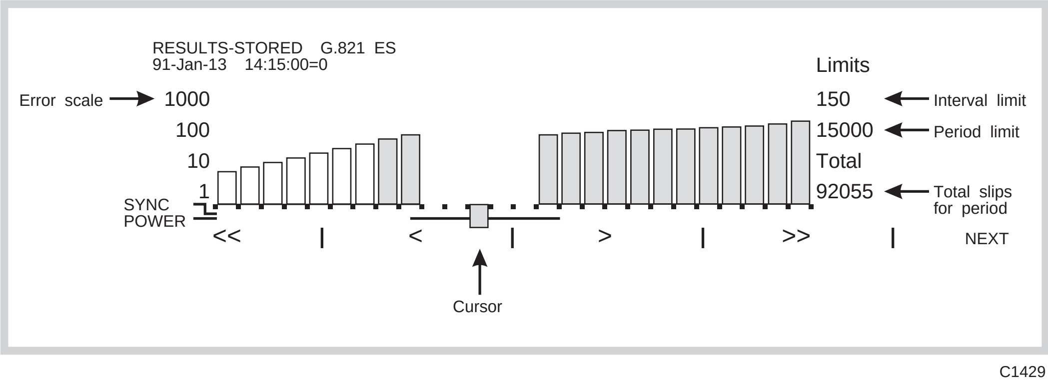


Fig. 3-10 ES Histogram display page example.

Four bar graph pages display a graphical representation of the stored G.821/G.921 measurement results during the test. Errors can be recorded over a maximum of 100 intervals with intervals of 1 day, 1 hour, 30 minutes, 15 minutes as set by the user in the TEST - STORED G.821 SETUP page. Page width represents 30 intervals. The indicated errors will be for the major error type selected in the TEST-PARAMETERS page i.e. either line code, pattern, framing or CRC errors.

The display histogram pages show the number of errors recorded per interval as vertical bars graduated according to a pseudo-logarithmic scale indicated at the left-hand side of the display by the numbers 1, 10, 100 and 1000.

For SES, ES and DM pages, (but not for BRKS pages), the interval and period limits are shown to the right of the bar graph. For all pages, the total errors recorded (during all the intervals stored up to the maximum store length) are also displayed to the right of the bar graph.

The histogram bars are normally drawn as solid but if the number of errors recorded during the interval exceeds the specified limit, the bar is drawn striped. This enables the user to immediately identify any intervals during which the number of errors has exceeded the acceptable limit.

Cursor movement

A cursor may be moved along the baseline of the histogram and the number of errors, date and time for the interval at the cursor position are displayed above the bar graph. For the breaks page the percentage unavailable (% Unav) time for the interval is also shown.

Display other intervals off-page

Each histogram display page can show a maximum of 30 stored interval records. For store lengths of more than 30 intervals, the cursor may be used to select earlier or later records to be displayed. To display records preceding those currently displayed, the cursor is moved to the extreme left of the page using *[<<]* soft key. Pressing the *[<]* soft key causes the earlier records to move in one at a time from the left: pressing the *[<<]* soft key causes the previous 30 records to be read in and displayed. To select records following the currently displayed records, the cursor is moved to the extreme right of the page using the *[>>]* soft key. Pressing the *[>]* soft key causes the later records to move in one at a time from the right: pressing the *[>>]* soft key causes the following 30 records to be read in and displayed.

Moving between pages

A single soft key *[NEXT]* is used to rotate around the ES, SES, DM and BRKS display pages. For example, if the ES page is displayed pressing the soft key *[NEXT]* will cause the SES page to be displayed. The next press will display the DM page. In this way all the G.821 display pages may be selected.

'Sync' and 'power' markers

Description for Sync and power markers for RESULTS-STORED G.821 pages is the same as that given for RESULTS PAGES-Sync and power markers on page 3-87.

Results-demux errors

For instruments with Mux/Demux facility displays on 4 pages the Demux Framing, %ES, %EFS and Errors listed under each Frequency/Tributary heading.

Framing page displays FW, FB, total and ratio errors.

%ES displays %ES, %SES and % Unavailable secs.

%EFS displays %EFS, NON-SES and % Available secs.

Errors page displays ES, SES and Unavailable secs.

A single soft key *[NEXT]* is used to rotate round the pages.

FW Total is the total number of frame words in error.

FB Total is the total number of frame bits in error.

FW Ratio is the total number of frame words in error divided by the total number of frame words received.

FB Ratio is the total number of frame bits in error divided by the total number of frame bits received.

Results-SDATA errors

For instruments with Structured Data facility, displays the pattern and framing errors on 4 pages listed under Errors, %ES, %EFS and ES.

Errors displays the errors detected, the error ratio and the total number of bits in error.

%ES displays %ES, %SES and % Unavailable secs.

%EFS displays %EFS, NON-SES and % Available secs.

ES displays.

Results-sync status

Lists the number of events, the total duration of events in seconds and indicates the current status during a test for the loss of received signal, AIS detected, loss of frame synchronization, loss of pattern synchronization and loss of CRC synchronization. The results are continuously updated during the test.

Note **An active alarm condition is indicated by '<<' against one of the above text headings. Only the highest priority alarm is indicated at any one time.**

For instruments with Mux/Demux facility the Demux sync status can also be displayed during a test. Access the required page by pressing the appropriate soft key *[2M]*, *[8M]* or *[34M]*. Press *[NEXT]* soft key to return to the first page.

For instruments with Structured Data facility facility the SDATA sync status can be assessed by pressing *[NEXT]* soft key. The number of events and duration in seconds for Frame sync, Pattern sync and Signal loss are listed.
If the operating mode is PCM+SDATA then the Signal loss line is not present.

Results-bursts

The type of error bursts monitored depend on the 'major error type' selected in the TEST-PARAMETERS page. The following characteristics are measured and displayed:-

Number of bursts.

Duration since last burst occurred in:	days,hours,minutes,seconds,milliseconds.
Duration between the last two bursts in:	days,hours,minutes,seconds,milliseconds.

Results-octet slips

Indicates octet slips detected in the received pattern data of a framed single channel. Octet slips can occur in a 64 kbit/s channel when a frame is repeated or deleted in the buffers between networks. The following characteristics are measured and displayed:-

Number of positive slips.

Number of negative slips.

Duration since last slip occurred in days,hours,minutes,seconds.

Duration between the last two slips in days,hours,minutes,seconds.

Results-sync slips

Indicates sync slips (1544 or 2048 kbit/s systems only).

Two primary rate signals (1544 kbit/s or 2048 kbit/s) are compared for synchronisation. A sync slip is registered for each bit of relative phase shift between the clock extracted from the connected reference signal and the clock extracted from the receive input signal. The number of sync slips per second, and since the start of test are displayed.

The received input frequency and the reference input frequency are also displayed.

Printer and sharer operation

Introduction

An external printer can be used to :

- print any page displayed by the 2851 (screen dump using the [PRINT DISPLAY] key facility or
- automatically print (Autoprint) results as programmed in the CONFIGURE-EVENT PRINT and INTERVAL PRINT pages or
- print Autoprint text held in RAM and selected for print on the STORE/RECALL Autoprints pages.

On the 2851, select CONFIGURE-PORT page and assign RS-232 port to PRINTER or SHARER or (if GPIB option fitted) assign GPIB port to PRINTER. Select the parameter options appropriate to the printer and enter print-out identity number and print-out label on the CONFIGURE-PRINTER page. Note that the column width of the printer must be at least 40 characters.

Note

When using the optional scriptos printer, ensure that it is set to Epson emulation mode by setting the DIL switches 6, 7 and 8 to ON , ON and OFF respectively (refer to the printer manual).

Configure-port page

Select PRINTER for direct connection to a printer. In this mode RTS is asserted and removed during messages as required.

Select SHARER (RS-232 only) for connection to a common printer via a printer sharer. In this case RTS is asserted for the whole message thereby denying access to the printer by other 2851 instruments.

RS-232 printer/sharer selections

Baud rate

Select one of the following baud rates:- 300, 600, 1200, 2400, 4800, 9600.

Format

Select the data format to be one of the following:-

701	=	7 code bits odd parity and 1 stop bit
702	=	7 code bits odd parity and 2 stop bits
7E1	=	7 code bits even parity and 1 stop bit
7E2	=	7 code bits even parity and 2 stop bits
*8N1	=	8 code bits no parity and 1 stop bit
*8N2	=	8 code bits no parity and 2 stop bits

* Note

Required for printing an identical copy of display pages containing graphics characters.

Handshake

Select handshake to be either software only, hardware only or hardware and software. For handshakes using hardware, control lines DTR, DSR, RTS and CTS are used. For handshakes using software, characters X-ON and X-OFF are used.

Note **For printers with short buffers, or which send X-OFF or drop DSR when the buffer is nearly full, the baud rate must be reduced to enable the 2851 to respond. For the EPSON P.40 printer, for example, use 2400 (or less) for TEXT and 1200 (or less) for GRAPHICS.**

Hardware and software

Full duplex modem control with X-ON/X-OFF. Suitable for interfacing 2851 with a modem. See Fig. 3-11.

Data transmission is stopped by either:-

Removing CTS (resumed by reasserting CTS) or
Sending X-OFF (resumed by sending X-ON).

Hardware only

Full duplex modem control only. Suitable for interfacing via a null-modem. See Fig. 3-14.

Data transmission is stopped by either:-

Removing CTS (resumed by reasserting CTS).
Removing DSR (resumed by reasserting DSR).
Removing RLSD (resumed by reasserting RLSD).

Software only

Full duplex with X-ON and X-OFF control only. All hardware handshake lines are ignored.

Data transmission is stopped by:-

Sending X-OFF (resumed by sending X-ON).

GPIB printer selections

Mode

Select LISTEN ONLY or ADDRESSED.

The listener addressed number can be set to be in the range 0 to 30

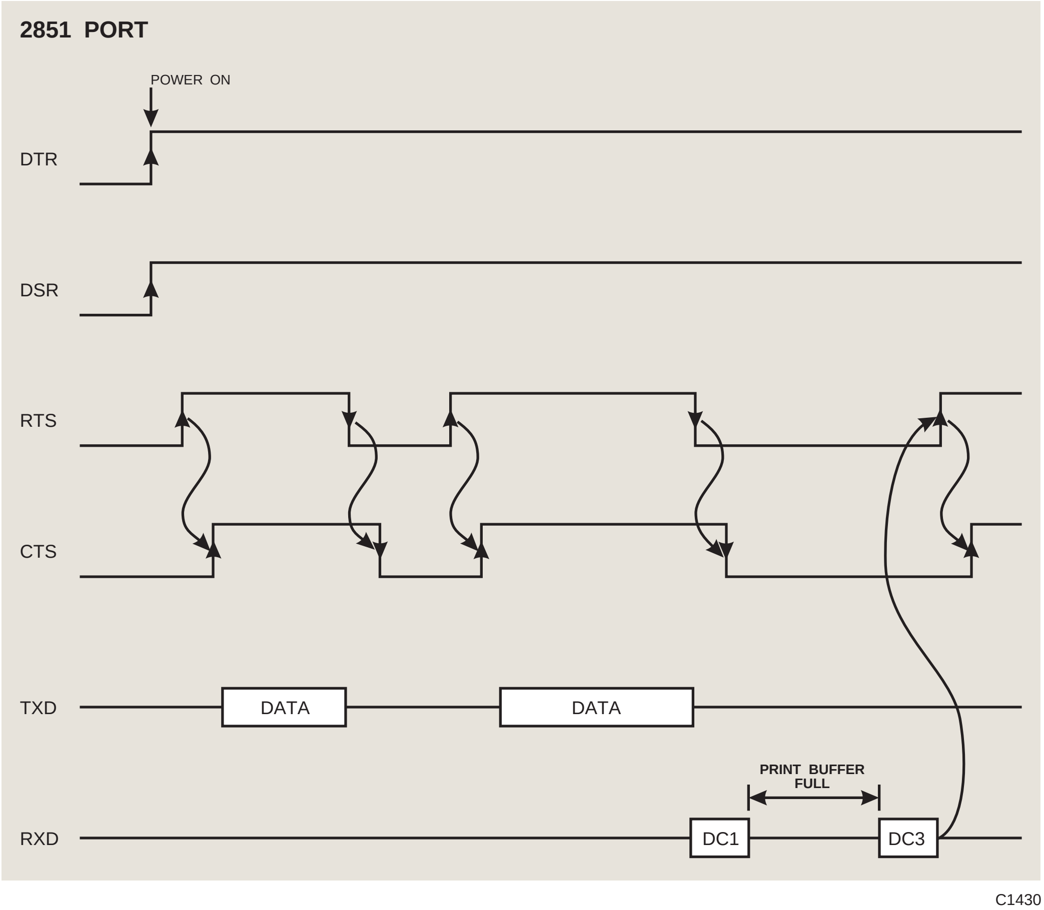


Fig. 3-11 Printer handshake protocol via modem using hardware and software handshake

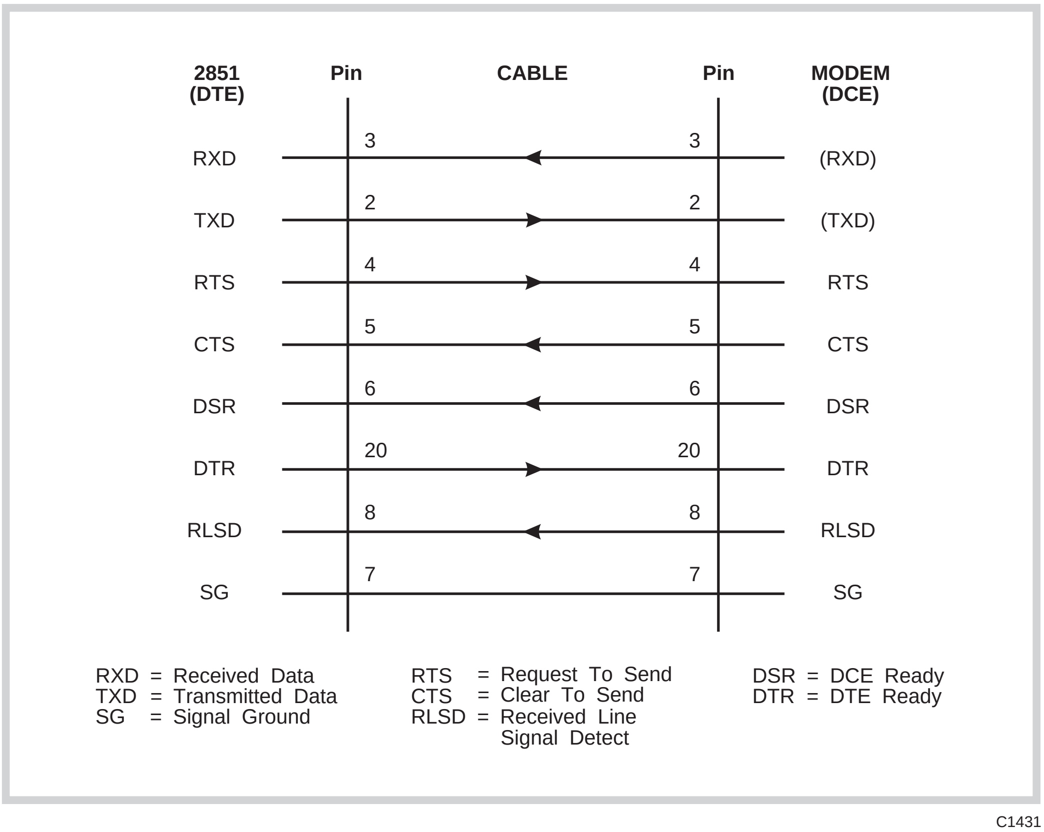


Fig. 3-12 RS-232 Modem hardware lines

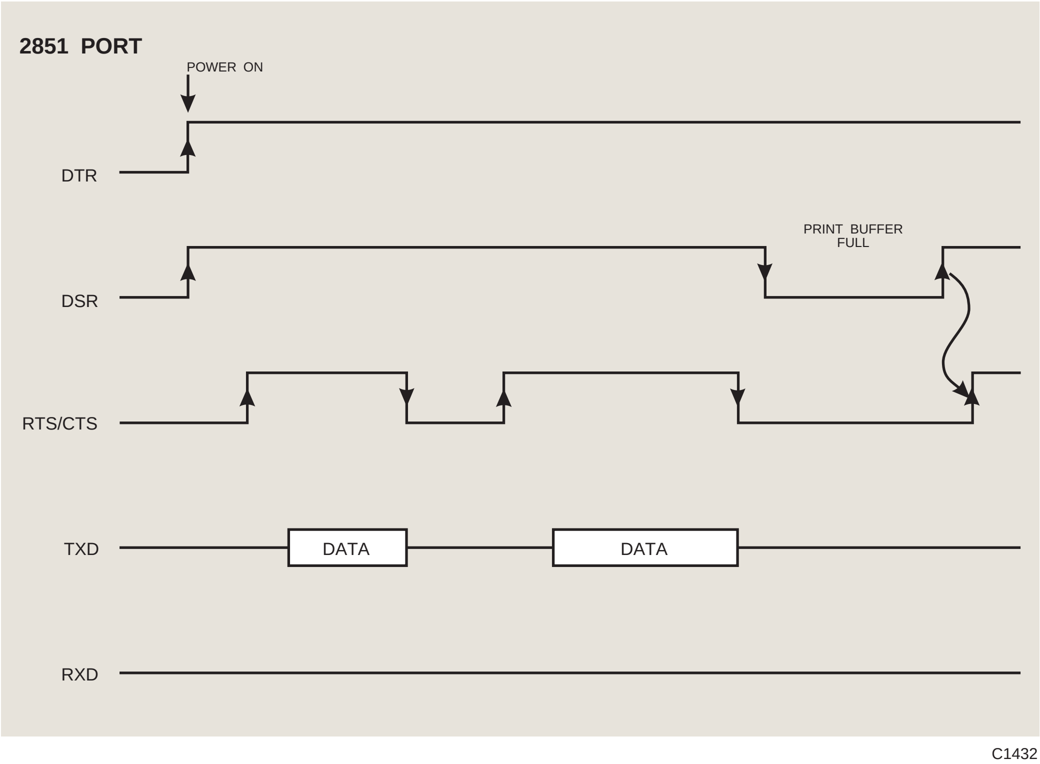


Fig. 3-13 Printer handshake protocol via null-modem using hardware handshake only

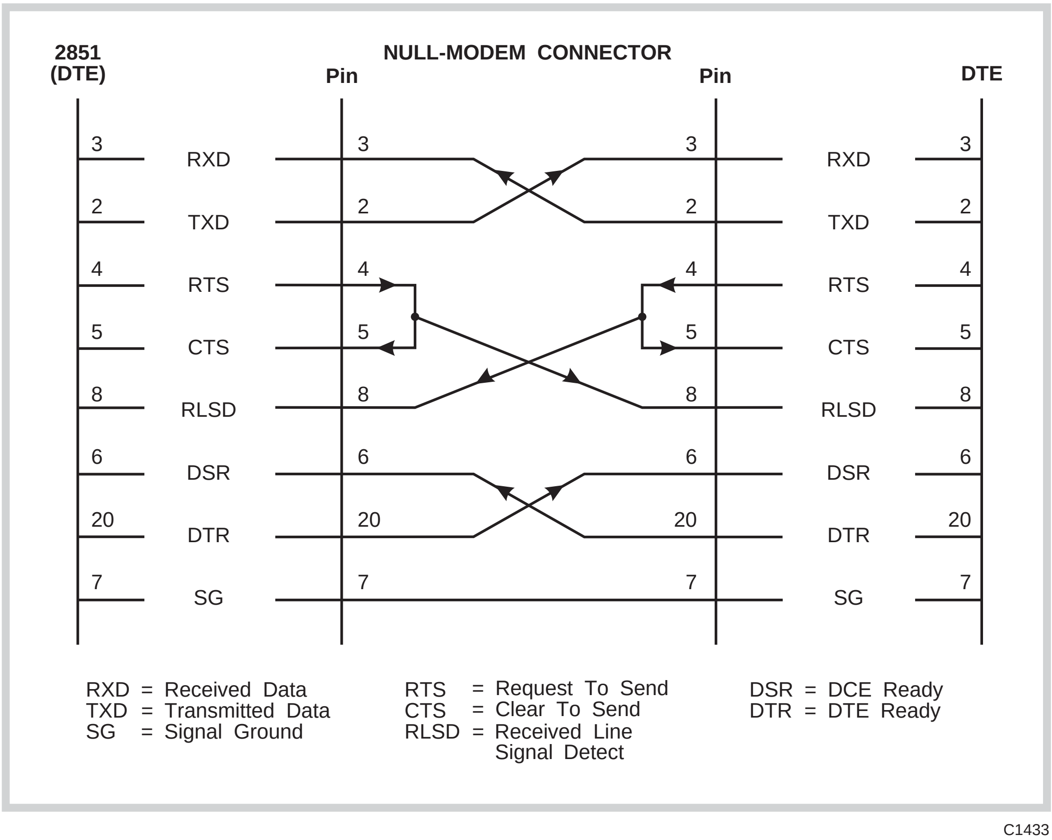


Fig. 3-14 RS-232 Null-modem hardware lines

Configure-printer page

Type

Select printer type to be either TEXT ONLY or GRAPHICS.

TEXT ONLY should be selected if the printer is unable to print graphics characters and symbols as displayed by the 2851. This is only noticeable when a display page with graphics is printed e.g. RESULTS-STORED HOURS. The TEXT ONLY print-out will be identical to the displayed page except text characters and symbols are substituted for the display graphics. A GRAPHICS print-out should be identical to the displayed page.

Terminator

Select print terminator to be either None, Carriage Return, Line Feed or Carriage Return and Line Feed.

ID No. (Identity number)

Enter a numerical value (0-99) which will be printed on every print-out to identify the source instrument. Useful if the printer is shared with other instruments.

Label

Enter a label of up to 12 characters which will be printed on every print-out to identify sets of printed results.

Print to

Test results can be sent to the printer, or alternatively can be sent to RAM and stored for later examination/printing.

Screen dump examples

These are examples of printed display pages. A page is printed when the [PRINT DISPLAY] key is pressed.

CONFIGURE-PORT page with
Type set to
TEXT ONLY
(for printer without
graphics capability)
DEMO PRINT = User entered label.

```
92-10-09  23:40:16   DEMO PRINT         01
CONFIGURE-PORT
------RS-232------        ------GPIB------
Used for  :  PRINTER      Used for :  NONE
Baud Rate :  9600
Format    : >8 N 2

Handshake :  HARDWARE AND SOFTWARE

8 N 1    8 N 2                        MORE
```

23:40:16 = Time of print-out
92-10-09 = Date of print-out

01 = User entered instrument identity.

> = Indicates the highlighted option i.e. 8 N 2

CONFIGURE-PRINTER page with Type set to GRAPHICS (for printer with graphics capability) The highlighted option GRAPHICS is indicated as it is displayed.

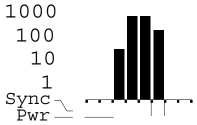
```
92-10-14 23:40:48 DEMO PRINT          01
CONFIGURE-PRINTER
Printer Type    :  GRAPHICS
..Terminator    :  CR+LF
Printout ID No. :  1
Label           :  DEMO PRINT



 TEXT     GRAPH
```

RESULTS-STORED MINUTES page with Type set to GRAPHICS. The following also apply to the -STORED HOURS page. Position of cursor is indicated by a vertical line each side of the minute interval on the base line.

```
92-10-14 15:10:10 DEMO PRINT           01
RESULTS-STORED MINUTES         TEST RUNNING
10000                           CURSOR AT
 1000                           92-OCT-14
  100                           15:10:00
   10                          Err : 576
    1                          Es  : 60
 Sync                          Ses : 0
  Pwr
 <<        <        >        >>       NEXT
```



RESULTS-STORED MINUTES page with Type set to TEXT ONLY.
The following also apply to the -STORED HOURS page.
Errors are approximated using the cross-hatch character #.

```
92-10-14 15:12:41 DEMO PRINT           01
RESULTS-STORED MINUTES         TEST RUNNING
10000                           CURSOR AT
 1000                           92-OCT-14
  100      ##                   15:10:00
   10     ####                 Err : 576
    1     ####                 Es  : 60
        sbp..^.......          Ses : 0
  <<        <        >        >>      NEXT
```

's'	=	Sync loss occurred in the minute interval above.
'p'	=	Power loss occurred in the minute interval above.
'b'	=	Sync and power were both lost in the minute interval above.
'.'	=	No sync or power loss occurred in the minute interval above.
'^'	=	Indicates the cursor position with no sync or power loss.

Note **When the cursor is positioned on the minute in which sync loss, power loss or both occurred,** s, p **or** b **will be upper case.**

Results-stored G.821 page examples

For the Stored G.821 pages the print display is slightly modified in that the page dump is followed by a text expansion of the intervals displayed on the page. The results are available for a [SHIFT] plus [PRINT DISPLAY] function which provides a text dump of all stored G.821 parameters (ES, SES, DM, BRKS & %UNAV) for the entire period covered by the stored intervals.

RESULTS-STORED G.821 ES page
with type set to
TEXT ONLY.
Errors are approximated using the cross-hatch character #.
* = Limit exceeded.
Press [PRINT] key.

Representation of page is followed by listing of errors recorded.
SES, DM & BRKS are similarly printed

* = Limit exceeded

P = Power Loss

S = Sync Loss

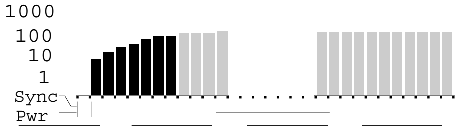
^ = Indicates cursor position

```
92-10-14 15:12:37   DEMO PRINT          01
RESULTS-STORED G.821 ES
92-OCT-13 14:15:00 = 0              Limits
1000                                150
 100      ##****         ***********15000
  10 ##########****      ***********Total
   1 ##########****      ***********92055
    ^...........pppppppppp...........
  <<        <       >      >>      NEXT

G.821 STORED INTERVALS OF 15-MIN
LIMITS ARE USER DEFINED
92-10
DATE TIME   ES   STATUS
13   14:15  0
13   14:30  19
13   14:45  38
13   15:00  57
13   15:15  76
13   15:30  95
13   15:45  114
13   16:00  133
13   16:15 *152
13   16:30 *171
13   16:45 *190
13   17:00 *209    P
13   17:15  -----  P
to
13   18:45  -----  P
13   19:00 *361    P
13   19:15 *380
13   19:30 *399
13   19:45 *418
13   20:00 *437
13   20:15 *456
13   20:30 *475
13   20:45 *494
13   21:00 *513
13   21:15 *532
13   21:30 *551
```

RESULTS-STORED G.821 ES
with type set to
GRAPHICS.
Position of cursor is indicated
by a vertical line each side of
the minute interval on the base line.

```
92-10-14 15:12:00 DEMO PRINT           01
RESULTS-STORED G.821 ES
92-OCT-13 14:15:00 = 0
```




```
Limits
150
15000
Total
92055
```

<<   <   >   >>   NEXT

Press [PRINT] key.
Representation of page
is followed by listing
of errors recorded.
SES, DM & BRKS are
similarly printed

```
G.821 STORED INTERVALS OF 15-MIN
LIMITS ARE USER DEFINED
92-10
DATE TIME   ES   STATUS
13   14:15  0
13   14:30  19
13   14:45  38
13   15:00  57
13   15:15  76
13   15:30  95
13   15:45  114
13   16:00  133
13   16:15 *152
13   16:30 *171
13   16:45 *190
13   17:00 *209    P
13   17:15  -----  P
to
13   18:45  -----  P
13   19:00 *361    P
13   19:15 *380
13   19:30 *399
13   19:45 *418
13   20:00 *437
13   20:15 *456
13   20:30 *475
13   20:45 *494
13   21:00 *513
13   21:15 *532
13   21:30 *551
```

* = Limit exceeded

P = Power Loss

S = Sync Loss

RESULTS-STORED G.821
Text representation of entire store contents.

Press [SHIFT]+[PRINT DISPLAY] key on any STORED G.821 display page..

* = Limit exceeded

P = Power Loss

S = Sync Loss

```
92-10-14 15:12:00  DEMO PRINT           01
G.821 STORED INTERVALS OF 15-MIN
          SES      ES      DM     BRKS
TOTAL    *33915  *92055  *9690    4845
PER LIMIT 1200    15000   600
INT LIMIT 12      150     6
LIMITS ARE USER DEFINED
92-10
DAY/TIME   SES  ES   DM  BRKS  %UNAV
13  14:15  0    0    0   0     0.00
13  14:30  7    19   2   1     3.312
13  14:45 *14   38   4   2     6.625
13  15:00 *21   57   6   3     9.937
13  15:30 *35   95  *10  5    16.562
13  15:45 *42   114 *12  6    19.875
13  16:00 *49   133 *14  7    23.187
13  16:15 *56  *152 *16  8    26.500
13  16:30 *63  *171 *18  9    29.182
13  16:45 *70  *190 *20  10   33.125
13  17:00 *77  *209 *22  11   36.437  P
13  17:15 -------------------------  P
to
13  18:45 -------------------------  P
13  19:00 *133 *36  *38  19    3.312  P
13  19:15 *140 *380 *40  20    6.625
13  19:30 *147 *399 *42  21    9.937
13  19:45 *154 *418 *44  22   13.250
13  20:00 *161 *437 *46  23   16.562
13  20:15 *168 *456 *48  24   19.875
13  20:30 *175 *475 *50  25   23.187
13  20:45 *182 *494 *52  26   26.500
13  21:00 *189 *513 *54  27   29.812
13  21:15 *196 *532 *56  28   33.125
13  21:30 *203 *551 *58  29   36.437
13  21:45 *210 *570 *60  30   39.749  S
13  22:00 *217 *589 *62  31   43.062  SP
13  22:15 *224 *608 *64  32   46.374
```

Event print examples

When Event Print is selected and Print to PRINTER is selected in the CONFIGURE-PRINTER page, results of tests on the occurrence of specified events are automatically printed while the test is running.

Previous Event test results that were not printed but stored as print files in RAM can also be recalled and printed as selected on the STORE/RECALL-Autoprints page.

In either case the presentation of information printed is the same as shown in the examples below. These are examples of prints that can occur when a test is running.

Power lost

Power lost at 19:06:21
on 92-10-06.
Power returned at 19:06:36
on 92-10-06.

```
92-10-06  19:06:36   POWER RECOVERY     01
POWER LOST:-             92-10-06 19:06:21
TEST RESTARTED           NO ALARMS PRESENT
```

Test start

PCM System selected

Test started at 18:57:58.
Rx and Tx selected parameter options are printed.

```
92-10-06  18:57:58  START OF TEST       01
IFR2851 ID: 00     Label : DEMO PRINT
Test Mode  : INDEF  Major Error : Framing
++ RX SETUP ++        ++ TX SETUP ++
System    : 2M        System    : 2M
Line code : HDB3      Line code : HDB3
Test mode : FRAMED    Test mode : FRAMED
Sync to   : PRBS      Carrying  : PRBS
Input mode: TERMINATED
++ AUTOPRINT SETUP ++
Event Print  : ON   Interval Print : OFF
Alarm Change : YES  Interval  : 15 MINS
Errored Sec. : YES  Major Errors   : NO
Sig. Change  : YES  Other Errors   : NO
Threshold ...: YES  Sync Slips     : NO
          ...1E-06  Performance    : NO
                    Stored Results : NO
```

DATA System selected

Test started at 19:48:41.
Rx and Tx selected parameter options are printed.

```
92-10-09  19:48:41  START OF TEST       01
IFR2851 ID: 00    Label : DEMO PRINT
Test Mode  : TIMED Major Error : PATTERN
++ RX SETUP ++       ++ TX SETUP ++
System   : RS232     System   : RS232
Test mode: SYNC      Test mode: SYNC
Clk. rate: 9600      Clk. rate: 9600
Sync to  : PRBS      Carrying : PRBS
++ AUTOPRINT SETUP ++
Event Print  : ON   Interval Print : ON
Alarm Change : NO   Interval  : 15 MINS
Errored Sec. : NO   Major Errors   : NO
Sig./ISDN Ch.: YES  Other Errors   : NO
Threshold ...: NO   Sync Slips     : NO
          ...1E-06  Performance    : NO
                    Stored Results : NO
```

SDATA System selected

Test started at 00:43:23
Rx and Tx selected parameter options are printed.

```
93-03-10  00 43:23  START OF TEST       00
IFR2851 ID: 00    Label : 2851
Test Mode  : INDEF Major Error : SD PATT
++ RX SETUP ++       ++ TX SETUP ++
Interface : V11      Interface : V11
Line code: NRZ       Line code : NRZ
Structure : X50 20   Structure :X50 20
Sync to  : PRBS      Carrying : PRBS
++ AUTOPRINT SETUP ++
Event Print  : OFF   Interval Print : ON
Alarm Change : NO    Interval  : 15 MINS
Errored Sec. : NO    Major Errors   : YES
Sig./ISDN Ch.: NO    Other Errors   : YES
Threshold ...: NO    SDATA ERRORS   : YES
          ...1E-06   DEMUX Errors   : NO
                     Stored Results : NO
```

Rx/Tx parameter changed

Tx parameter option was changed by the user during a test.

```
92-10-06 19:11:16 TX SETUP CHANGED    01
```

Autoprint parameter changed

If Autoprint is enabled or changed during the test, all current Autoprint parameter settings are printed.

Autoprint enabled:-

Print on interval selected.
Interval = 15 minutes.
Include the stored results for the interval and the performance data of the test.

Print on crossing error ratio threshold (Major error type).

Threshold set to 1×10^{-6}.

Print on errored seconds is off.

Print on signalling change is on.

Print on alarm change is on.

```
92-10-06 19:08:08 AUTOPRINT CHANGED   01
Event Print  : ON   Interval  Print : ON
Alarm Change : YES  Interval   : 15 MINS
Error Sec.   : NO   Major Errors   : NO
Sig. Change  : YES  Other Errors   : NO
Threshold ...: YES  Sync Slips     : NO
          ...1E-06  Performance    : YES
                    Stored Results : YES
```

Errored second

When errored second is enabled, during any second when an error occurs, the current total of errored seconds and severely errored seconds together with the total number and rate of errors of the type which occurred during that second are printed:-

```
93-11-06 19:00:46 ERRORED SECOND      01
Pattern ES     : 123       SES  : 12345
34M FB Errors  : 12       ratio : 1.2E-03
```

For G.826/M.2100, when FORWARD PATH = ON, printout occurs whenever any E-bit errors are detected.

Note **Errors measured in ANY of the error counters will trigger the errored second printout, but the ES and SES counts will only increment when errors are measured in the major error type.**

Burst error

Printed on the occurrence of a burst error when Errored Second is enabled in the Configure-Event Print page:-

Time between last two bursts is given in days, hours, minutes, seconds and milliseconds.

```
92-10-07 12:34:00 BURST ERROR         01
Bursts : 12345          Threshold : 256
Burst interval :        00 00:12:34.567
```

Octet slips

Printed on the occurrence of an octet slip when Errored Second is enabled in the Configure-Event Print page:-

A print-out will indicate a positive or negative slip or both.

Time between last two octet slips is given in days, hours, minutes and seconds.

```
92-10-07 12:34:00 POS/NEG OCTET SLIPS 01
Positive : 123            Negative : 123
Slip interval :              00 12:34:56
```

Signalling change

Rx signalling channel changed or Rx signalling code changed in the selected channel:-
Note that this print-out is suppressed during dialling sequences.

```
92-10-07 12:34:00 SIGNALLING CHANGED  01
Channel : 12 Present : 3   Previous : 5

92-10-07 12:34:00 RX CHANNEL CHANGED  01
Channel : 12 Present : 3
```

Rx signalling channel received a dialling sequence:-

```
92-10-07 12:34:00 DIALLING CHANGED    01
Channel : 12
Dialled : 12345X7890
Error   :      3
```

`X` indicates a dialling error. Error codes are described in PCM-Receiver pages, signalling monitor section.

ISDN error report

Printed on the occurrence of ISDN Error report bits.

2M/CnoMF system selected.

Error report bits are to CCITT Rec. G96Y

1/9, 3/11, 5/13 & 7/15 are the CRC multiframe inframe pairs.

```
92-10-10 00:06:49 ISDN ERROR REPORT   01
1/9:S..   3/11:.D.   5/13:..E   7/15:...
```

Error indications are printed in relation to the error alarm pulses detected within bits 6, 7 & 8 of the Not Frame word. eg. S.. = bit 6, .D. = bit 7, ..E = bit 8.

E = Errored seconds
D = Degraded minutes
S = Severely errored seconds

2M/noMF system selected.

00, 01, 10 & 11 are the values for error alarm pulses (bits 4 & 5 of the Not Frame word).

```
92-10-10 00:22:15 ISDN ERROR REPORT   00
00:S..    01:.D.    10:..E   11:...
```

Error indications are printed in relation to the error alarm pulses detected within bits 6, 7 & 8 of the Not Frame word. eg. S.. = bit 6, .D. = bit 7, ..E = bit 8.

E = Errored seconds
D = Degraded minutes
S = Severely errored seconds

Threshold crossed

Pattern error ratio threshold crossed.

```
92-10-07 12:34:00 THRESHOLD CROSSED   01
Pattern errors             ratio < 1E-04
```

Pattern errors have become less than the threshold of 1×10^{-4}.

Pattern error ratio threshold crossed.

```
92-10-07 12:34:00 THRESHOLD CROSSED   01
Pattern errors             ratio > 1E-04
```

Pattern errors have become greater than the threshold of 1×10^{-4}.

Alternatively the error type could be Code errors, Framing errors (including Demux Framing errors), or CRC errors, depending on the major error type for the current test.

Limit exceeded

ESR limit exceeded during G.826 performance measurement.

```
96-02-14 12:07:30 LIMIT EXCEEDED       00
G.826 ESR
```

Alarm changes (if enabled and test running)

The present status of each alarm is compared with the status of each alarm for the previous second. A message is printed if the alarm has changed status. Only the highest priority alarm set is indicated with any lower priority alarms just reset.

Line signal lost:-

Line signal returned:-

```
92-10-06 20:09:40 ALARM CHANGE        01
SIGNAL :                            LOST
92-10-06 20:09:41 ALARM CHANGE        00
SIGNAL :                        RETURNED
```

Other alarm change messages

Alternative messages are indicated by the symbol /, eg. RETURNED/LOST

140M SIGNAL:	RETURNED/LOST
34M SIGNAL:	RETURNED/LOST
8M SIGNAL:	RETURNED/LOST
AIS:	ON/OFF
140M AIS:	ON/OFF
34M AIS:	ON/OFF
8M AIS:	ON/OFF
FRAME SYNC:	ACHIEVED/LOST
140M FRAME SYNC:	ACHIEVED/LOST
34M FRAME SYNC:	ACHIEVED/LOST
8M FRAME SYNC:	ACHIEVED/LOST
MULTIFRAME SYNC:	ACHIEVED/LOST
DISTANT ALARM:	ON/OFF
140M DISTANT ALARM:	ON/OFF
34M DISTANT ALARM:	ON/OFF
8M DISTANT ALARM:	ON/OFF
DISTANT MULTIFRAME ALARM:	ON/OFF

YELLOW ALARM:	ON/OFF
EXCESS ZEROS ALARM:	ON/OFF
64KBIT/S AIS:	ON/OFF
CRC MULTIFRAME SYNC:	ACHIEVED/LOST
PATTERN SYNC:	ACHIEVED/LOST
LED ERROR THRESHOLD ALARM:	ON/OFF
SDATA DATA SIGNAL:	RETURNED/LOST
SDATA TIMING SIGNAL:	RETURNED/LOST
SDATA FRAME SYNC:	ACHIEVED/LOST
SDATA FS SYNC:	ACHIEVED/LOST

Note **Although all the possible printouts are shown above listed together, in practise in most cases, only one or two will be printed simultaneously.**

Power returned after power failed during test

Power was lost at 20:47:01 on 92-10-06.

```
92-10-06 20:47:15 POWER RECOVERY      01
POWER  LOST :-        92-10-06  20:47:01
TEST RESTARTED         NO ALARMS PRESENT
```

Power returned at 20:47:15 on 92-04-06.

No alarms were present
at return of power.

Interval print examples

When Interval Print is selected and Print to PRINTER is selected in the CONFIGURE-PRINTER page, a summary of accumulated errors and measurements is automatically printed at the ends of successive intervals.

Summaries of accumulated errors and measurements for previous intervals that were not printed but stored as print files in RAM can also be recalled and printed as selected on the STORE/RECALL-Autoprints page.

In either case the presentation of information printed is the same as shown in the examples below.

If the test ends before the end of the next interval, an interval print will be printed up to the end of the test.

If the instrument was powered down during an interval print, on power-up an interval print will be printed starting from the end of the last successful interval print.

The print-out information depends on the currently selected measurements.

If Major errors selected:-
- Major error type = Pattern totalled 123 errors.
- Long term mean error ratio = 1.2×10^{-3}
- Current error ratio = 1×10^{-3}
- Residual error ratio = 1.3×10^{-3}

If Other errors selected:-
- Line code errors totalled 2 at a rate of 8.8×10^{-11}.
- Framing errors totalled 0.

```
92-10-06 22:55:00 INTERVAL PRINT      01
++ MAJOR ERRORS ++
Pattern errors       : 123
LTM error ratio      : 1.2E-03
Current error ratio  : 1E-03
Residual error ratio : 1.3E-03


++ OTHER ERRORS ++
Code errors    : 2         ratio 8.8E-11
FW errors      : 0         ratio 0.0E-00
FB errors      : 0         ratio 0.0E-00
```

If sync slips selected:-

```
++ SYNC SLIPS ++
Total Slips : -11657
```

If interval print is set to include G.821 Performance data, the following is also printed:-

Performance data with 0% = GOOD:-

Errored seconds = 2
Severely errored seconds = 2
Degraded minutes = 0
Unavailable seconds = 0
Breaks = 0

```
++ PERFORMANCE  G.821 ++
ES    : 2              SES   :  2
UAV S : 0              DM    :  0
Brks  : 0
% ES  : 0.013605       > limit      ON
% SES : 0.013605                    OFF
% DM  : 0.000000                    ON
% US  : 0.000000                    OFF
```

Percentage errored seconds = 0.013605
Percentage severely errored seconds = 0.013605
Percentage degraded minutes = 0.000000
Percentage unavailable seconds = 0.000000

If interval print is set to include stored results, the following is also printed:-

Interval started 05:37:38:-

The highest priority alarm present is indicated under STATUS.

Interval ended 05:52:00:-

```
++ STORED RESULTS ++
Interval start        92-10-07  05:37:38
MINUTE ERRORS  ES  SES  STATUS
05:37  1        1   0
05:38  16420  15    8
05:39  0        0   0
05:40  28378  59  14
05:41  113    59    0
05:42  47     25    0
05:43  0        0   0
05:44  1        9   8    SIGNAL LOST
05:45  0        0   0    SIGNAL LOST
05:46  0        0   0    SIGNAL LOST
05:47  0        0   0
05:48  1        1   0
05:49  12       4   0
05:50  5        1   0
05:51  0        0   0
Interval finish       92-10-07  05:52:00
```

If the whole interval is error and alarm free, nothing is printed. Only minutes with errored seconds or severely errored seconds are printed. If an Alarm is present for more than two consecutive minutes, only the initial and final completely alarmed minutes are printed followed by the results of the next minute irrespective of whether any errors occurred in it or not. Note that this is the only occasion when the results of a totally error and alarm free minute can be printed.

Note

Stored G.821 Results are not auto-printable. These pages are printed using [PRINT DISPLAY] or [SHIFT] plus [PRINT DISPLAY] when available in those pages.

Demux mode
2852(S) & 2853(S) (Option 14 only)

Major errors, other errors, and demux errors selected.

```
94-07-07 12:34:00 INTERVAL PRINT      01
++ MAJOR ERRORS ++
Pattern errors       : 123
LTM error ratio      : 1.2E-03
Current error ratio  : 1E-03
Residual error ratio : 1.2E-03
++ OTHER ERRORS ++
Code errors   : 12        ratio : 1.2E-03
++ DEMUX ERRORS ++
2M FW Errors : 123456789 ratio : 1.2E-03
2M FB Errors : 111       ratio : 1.2E-03
8M FW Errors : 123456789 ratio : 1.2E-03
8M FB Errors : 111       ratio : 1.2E-03
34M FW Errors: 123456789 ratio : 1.2E-03
34M FB Errors: 111       ratio : 1.2E-03
2M Perf. G.821        %    :   (%NON)
ES   : 0          0.000000 (100.000000)
SES  : 0          0.000000 (100.000000)
UAV S: 12         0.100000 ( 99.900000)
8M Perf. G.821        %    :   (%NON)
ES   : 0          0.000000 (100.000000)
SES  : 0          0.000000 (100.000000)
UAV S: 12         0.100000 ( 99.900000)
34M Perf. G.821       %    :   (%NON)
ES   : 0          0.000000 (100.000000)
SES  : 0          0.000000 (100.000000)
UAV S: 12         0.100000 ( 99.900000)
```

When Demux Errors is not selected and Other Errors is selected the Other Errors printout is increased to include a proportion of the demux errors as below.

Major errors, other errors selected, Demux errors not selected

.

```
94-07-07 12:34:00 INTERVAL PRINT      01
++ MAJOR ERRORS ++
Pattern errors       : 123
LTM error ratio      : 1.2E-03
Current error ratio  : 1E-03
Residual error ratio : 1.2E-03
++ OTHER ERRORS ++
Code errors   : 12        ratio : 1.2E-03
2M FW Errors : 123456789 ratio : 1.2E-03
2M FB Errors : 111       ratio : 1.2E-03
8M FW Errors : 123456789 ratio : 1.2E-03
8M FB Errors : 111       ratio : 1.2E-03
34M FW Errors: 123456789 ratio : 1.2E-03
34M FB Errors: 111       ratio : 1.2E-03
```

2854S & 2855S

Demux mode printouts are the same as for 2852(S) & 2853(S) Option 14 but with 140M FW & FB errors and 140M Performance results added.

Test stop

Autoprint to Printer

If Event Print is selected, when a test stops the end-of-test event is printed.

```
92-10-14 15:47:19 END OF TEST         01
```

If Interval Print is selected, when a test stops an interval print including all the selected interval print items is initiated.

Interval Print at End of Test
(with all parameters selected)

```
92-10-14 12:34:00 END OF TEST         01
++ MAJOR ERRORS ++
Pattern errors       : 123
LTM error ratio      : 1.2E-03
Current error ratio  : 1E-03
Residual error ratio : 1.2E-03
++ OTHER ERRORS ++
Code errors   : 12         ratio 1.2E-03
FW errors     : 1234       ratio 1.2E-03
FB errors     : 1234       ratio 1.2E-03
CRC errors    : 12345      ratio 1.2E-03
++ SDATA ERRORS ++
SD Frame      : 12         ratio 1.2E-03
SD Pattern    : 123        ratio 1.2E-03
++ SYNC SLIPS ++
Total Slips : 4
++ PERFORMANCE  G.821 ++
ES    :  12              SES     :  123
UAV S :  12345           DM      :  1234
Brks  :  12
% ES  :  12.123000       > limit :     ON
% SES :  12.123400                     OFF
% DM  :  12.123450                     ON
% US  :  12.123456                     OFF
++ STORED RESULTS ++
Interval start        92-10-14  12:19:00
MINUTE  ERRORS  ES SES   STATUS
12:19   0        0  0    SIGNAL LOST
12:20   -------------    AIS
12.21   -------------    F_SYNC LOST
12:22   -------------    M_F_SYNC LOST
12:23   >500000  0  0    DISTANT ALARM
12.24   1        1  1    DIST_M_F ALARM
12:25   12      12 12    YELLOW ALARM
12:26   123     59 59    EXCESS ZEROS
12:27   1234     0  0    64kbit/s AIS
12:28   12345    0  0    CRC ERROR
12;29   0        0  0    PATT SYNC LOST
12:30   0        0  0    POWER DOWN
Interval finish       92-10-14  12:30:29
```

Autoprint to RAM

If Event Print:ON or Interval Print:ON is selected to *RAM*, END-OF-TEST is not printed. The autoprint text (as detailed above) is sent to RAM (with other autoprint text for the Event or Interval test) and can be stored and printed later.

Battery operation

Operating modes

Operating switches and LED indicators are mounted on the side/rear of the unit as shown in Fig. 3-2. There are three modes of instrument operation when the battery unit is fitted. These are as follows:

Batteries Off

Set switches to BATTERY and **O** (Off).

Instrument operates from mains power. In this mode the batteries are trickle charged and all battery option indicator LED's are disabled.

Batteries Standby/On

Set switches to BATTERY and ⏻ (Standby/On).

Instrument operates from either mains power or from batteries when mains power is disconnected. The batteries are trickle charged when mains power is present. The red (low) LED gives an indication when the battery is low, when being discharged or too low when batteries are fully discharged.

Full charge

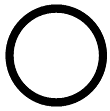
Set switch to CHARGE (other switch position irrelevant)

Batteries are charged at the full rate and the red CHARGE LED is on. The charge period is approximately 15 hours, after which time the charge rate is reduced to the trickle rate and the green (full) LED is turned on. No instrument operation is allowed in this mode.

If the batteries have been fully discharged the control circuitry prevents them from being used until at least some charge has been restored. This is usually about 1 hour of FULL charge.

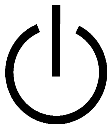
Symbols

The symbols used on the Battery Unit are explained below:-



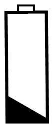
This is the *Off* symbol.

See *Batteries Off* on previous page.



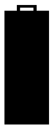
This is the *Standby/On* symbol.

See *Batteries Standby/On* on previous page.



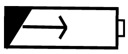
This is the *Batteries Low* symbol.

Used to identify LEDs that indicate low charge in battery Unit.



This is the *Batteries Fully Charged* symbol.

Used to identify LEDs that indicate full charge in battery Unit.



This is the *Charge Batteries* symbol. Used to identify the switch position to charge battery unit.

Display backlight

In order to conserve battery life, operation of the backlight is regulated in accordance with the battery capacity. The front panel REMOTE LED flashes to indicate when the backlight is switched off.

Capacity - GOOD:

If no key has been pressed for a period of 5 minutes the backlight switches off. This is followed by the front panel REMOTE LED flashing every 5 seconds. To reactivate the backlight press any key for a further 5 minutes illumination.

Capacity - LOW:

If no key has been pressed for a period of 30 seconds the backlight switches off. This is followed by the front panel REMOTE LED flashing every 2 seconds. To reactivate the backlight press any key for a further 30 seconds illumination.

Notes on battery life and capacity

Battery life and capacity are affected by the temperature at which charge and discharge takes place. High temperature charge and low temperature discharge both have the effect of reducing the capacity of the battery.

Battery capacity is reduced if shallow charge/discharge cycles are allowed for long periods. Full battery capacity can usually be restored if the unit is first fully discharged and then subjected to a full charge/discharge/charge cycle. This is also recommended if the battery has been in storage for a long period of time or has been held in a fully charged state for long periods.

The battery control board circuitry represents a constant drain on the battery especially if any of the LED indicators are on. To minimise this drain it is recommended that the instrument is not left in either the CHARGE or STANDBY modes with the mains disconnected for long periods. It is also recommended that the instrument be switched on periodically to maintain an adequate battery capacity.

Chapter 4
REMOTE OPERATION

Contents

List of tables

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Introduction

The command syntax for the 2851 GPIB and RS-232 remote operation is based on IEEE488.2. In RS-232 mode some IEEE488.2 features are not implemented due to the restriction of the interface.

Note

1) The GPIB option is only available as an option on the 'S' instrument versions.

2) The RS-232 port is a DTE, and hence needs to be connected to a DCE or via a null-modem to a DTE.

Selecting the remote interface

The remote interface can be selected by pressing the key sequence [CONFIGURE MENU] [ENTER], and then either the options 'RS-232 Used For' or the 'GPIB Used For' options can be set to 'REMOTE'.

For GPIB the 'Address' needs to be selected in the range 0 to 30 inclusive.

Note

The address of the controller must be avoided, this is normally 0.

For RS-232 three further options - Baud Rate, Format and Handshake need to be set to match the controller.

Baud rate

300
600
1200
2400
4800
9600
19200
38400

Format

7O1	7	data	bits	odd	parity	and	1	stop	bit.
7O2	7	"	"	"	"	"	2	"	"
7E1	7	"	"	even	"	"	1	"	"
7E2	7	"	"	"	"	"	2	"	"
8N1	8	"	"	no	"	"	1	"	"
8N2	8	"	"	"	"	"	2	"	"

Note

If 2 stop bits are selected then the 2851 will not accept characters with only one stop bit.

Handshake

Software only.

Flow control is achieved by X-ON/X-OFF.

Note

All control lines are normally in the OFF state, and are ignored.

Hardware and software.

Normally used in conjunction with a modem. The flow control between the 2851 and modem is achieved with the control lines and the flow control to the remote controller is achieved by X-ON/X-OFF.

Hardware only.

Flow control is achieved using DSR or CTS to suspend transmission from the 2851 and using DTR to suspend transmission from the controller.

Note **The 2851 will try and stop the controller from transmitting when the 2851's input buffer is nearly full, and will allow further transmission when the buffer has enough room for new data.**

The 2851 will continue to transmit for a few characters after receiving the command to stop transmission, the controller must have enough buffer space to cope with this extra data.

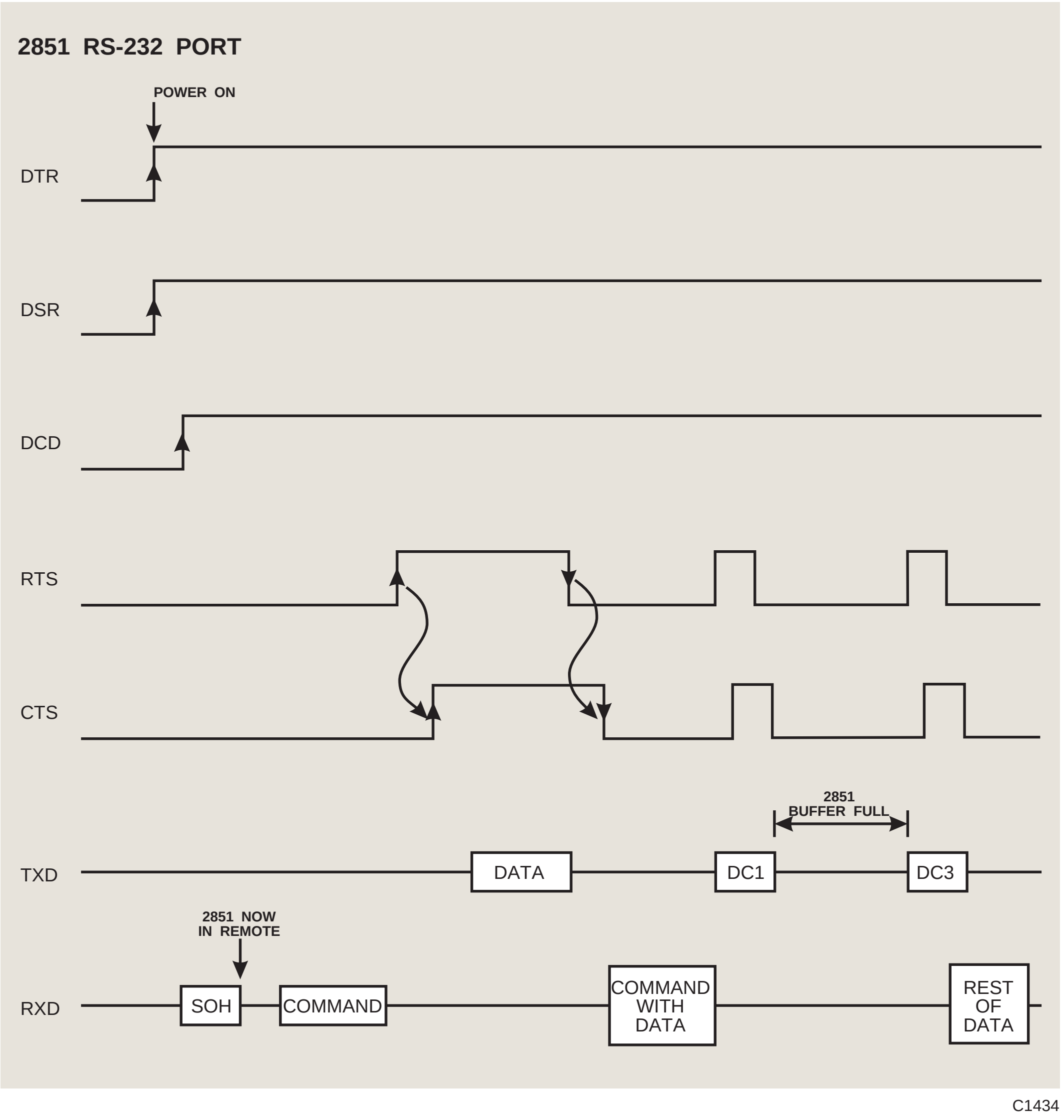


Fig. 4-1 Controller handshake protocol via modem using hardware and software handshake

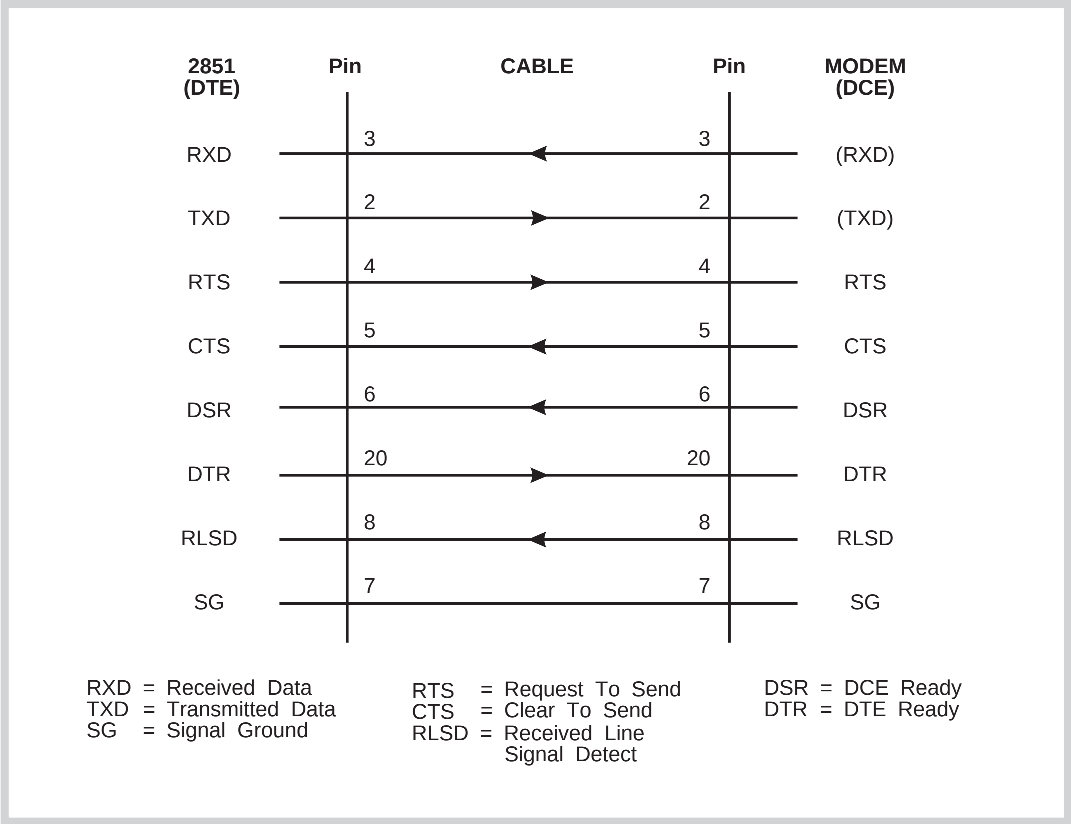


Fig. 4-2 RS-232 Modem hardware lines

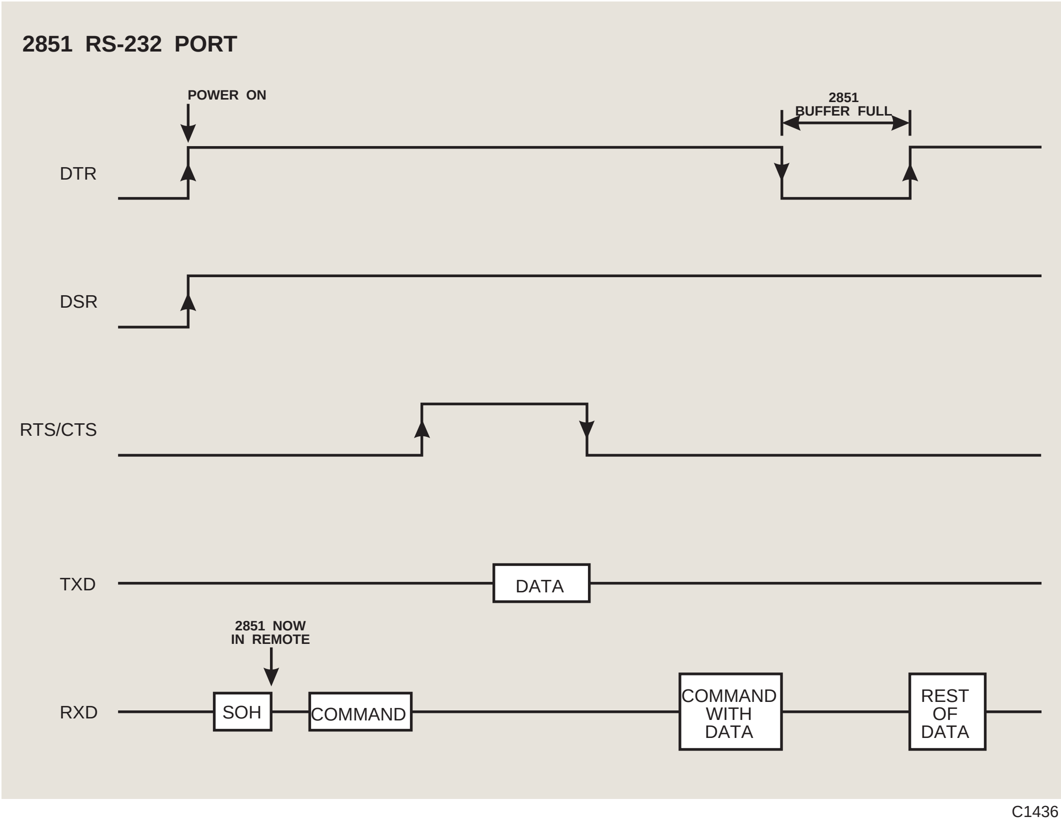


Fig. 4-3 Controller handshake protocol via null-modem using hardware handshake only

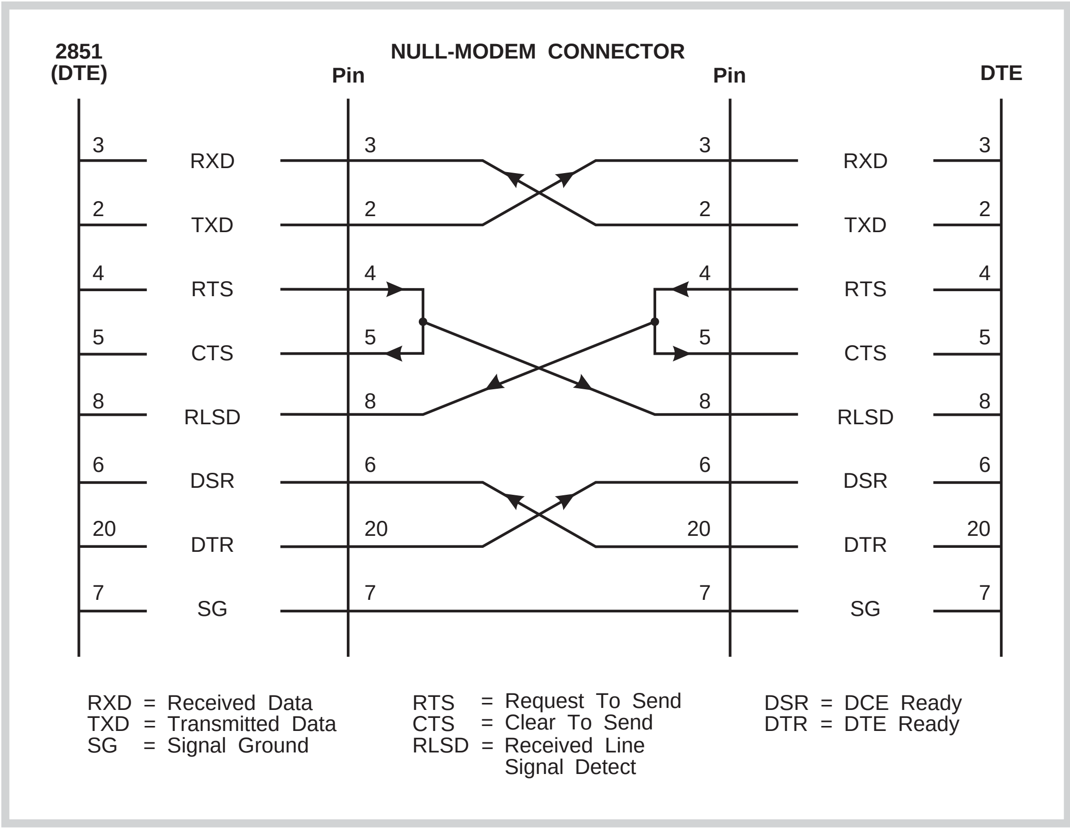


Fig. 4-4 RS-232 Null-modem hardware lines

Entering remote

GPIB

The 2851 will enter REMOTE when it receives the correct listen address, this is normally part of the send sequence of the controller software. The 2851 will receive the correct listen address if the controller sends:-

A string of data.
Selective device clear. (SDC)

RS-232

The 2851 will enter REMOTE if it receives either

^A (control A, 01H - connect)
^T (control T, 14H - device clear)

When in REMOTE the 2851 illuminates the REMOTE LED and displays 'IN REMOTE' in the top right of the display, (but see Local Lockout under special GPIB and RS-232 control sections).

Leaving remote

GPIB

The 2851 will return to local if it receives:

LOCAL	softkey pressed (if not LLO - local lockout)
gtl	(goto local message)
REN	(remote enable line) is dropped.

RS-232

The 2851 will return to local if it receives:

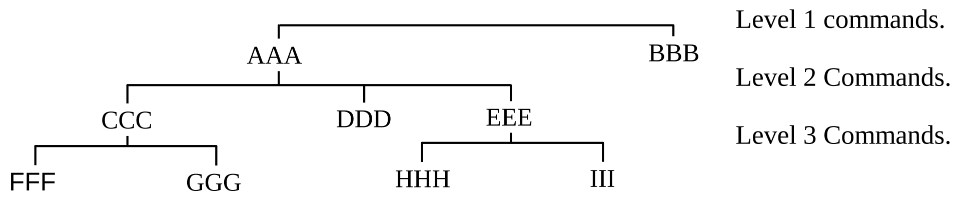
LOCAL	softkey pressed (if not LLO - local lockout)
^D	(control D, 04H - disconnect)
BRK	(Break, data line zero) for 2½ seconds.
DSR	(Data set ready line) is removed for 2½ seconds. (Hardware & software handshaking only)

Command syntax

The command format can be summarised by :-

<:>com<[:com]><?> <data><[,data]><[;<:>com<[:com]><?> <data><[,data]>]>term

where	< >	enclose optional command, data, or queries.
where	[ ]	enclose repeatable sections.
com	=	Command mnemonics.
data	=	Data values or selections.
term	=	Terminator (eg <lf>)



The general sequence for setting up a complex command would be :-

AAA:CCC:FFF n1;GGG n2;:AAA:DDD n3;EEE:HHH n4;III n5;:BBB n6

This can be reduced to :-

AAA:CCC:FFF n1;GGG n2;DDD n3;EEE:HHH n4;III n5;BBB n6

If a command is prefixed by a ':' then the parser assumes the command is a level 1 command. The parser will try and match commands at the same level as the previous command (if no ':' prefix's the command). If there is no match then the next level up is checked, if still no match the next level up is checked etc.

Command types

The following example commands cover the full range available in the 2851.

START Starts a test.	Single level command no data
DISPLAY 1 Changes the display to screen 1 (TX menu).	Single level command plus data.
DATE 93,1,4 Sets the date to 4th Jan 1993.	Single level command multiple data.
ERR_DIST:INC_MIN Increments minute cursor on the stored histogram page.	Two level command no data.
PRINTER_PORT:TERMINATOR 3 Sets the termination sequence for the print outs to CR+LF.	Two level command plus data.
G821:CURSOR_POS 93,1,4,9,30 Positions the G821 histogram cursor.	Two level command multiple data.
TEST:PARAMETERS:BUZZER 0 Disables the test buzz on alarm/error.	Three level command plus data.
TEST:PARAMETERS:TERM_AFTER 0,0,10 Set the test length to 10 seconds.	Three level command multiple data.
DATE? Return the date.	Single level query command.
TX_ERROR:STATUS Return the error injection status.	Two level query command.
TX_PCM:CONFIGURE:BIT_RATE? Return the Tx PCM bit rate setting.	Three level query command.
STORE? 0 Return store 0 parameters, name and status.	Single query command plus data.
STORE:STATUS? 1 Return store 1 status.	Two level query command plus data.
TX_ERROR? Return the Tx error injection parameters (only those which are applicable).	Top level query of two level command.
TEST? Return the test parameters (only those which are applicable).	Top level query of three level command.
RESULTS:DEMUX_34M:ERRORS: FRAME_BIT? Returns the demux 34mbit frame bit error count and error ratio.	Four level query command.
RESULTS? Returns all the results level command applicable to the test.	Top level query of four

Note

Alpha characters can be sent in either upper or lower-case with the same results.

DISPLAY TX_MENU is equivalent to Display TX_menu.

The only exception is in an ASCII string data type, where the case differences do matter.

STORE:STORE 1,"Trial Store"

Data types

Commands to the 2851

The data sent to the 2851 can be in several different forms depending on the command. The permitted types for each command are given in COMMAND FORMATS section, page 4-97.

ALPHA

In general all commands requiring a 'menu' selection will allow the ALPHA data type.

TX_PCM:CONFIGURE:AIS ON
TX_PCM:CONFIGURE:AIS OFF

Decimal (nr1,2,3)

Data sent in decimal format is converted to the required type, so that TX_PCM:CONFIGURE:AIS 1.02 would be converted to TX_PCM:CONFIGURE:AIS 1

Note **Floating point numbers are rounded for use as integers.**

Hexadecimal

Data can be sent in hex format TX_PCM:SIGNAL:SIG_CODE #Ha

Octal

Data can be sent in octal format TX_PCM:SIGNAL:SIG_CODE #Q12

Binary

Data can be sent in binary format TX_PCM:SIGNAL:SIG_CODE #B1010

Definite

This data type is not used for sending to the 2851.

Indefinite

This data type is not used for sending to the 2851.

String

Data can be sent in string format for two uses:

binary equivalent	TX_PCM:SIGNAL:SIG_CODE "1010"
or real string	STORE:STORE 1,"X21 BAL DCE"

Arbitrary Ascii

This data type is not used for sending to the 2851.

Commands from the 2851

The data returned by the 2851 can be in several different forms depending on the command. The permitted types for each command are given in COMMAND FORMATS section, page 4-97. The selection is controlled by the OUT_FORMAT command.

Note **If the type selected by OUT_FORMAT is not compatible with the command requested, the DEFAULT data type is used.**

Alpha

(OUT_FORMAT ALPHA)

In general all command allowing a 'menu' selection will allow the ALPHA data type to be returned.

TX_PCM:CONFIGURE:AIS?

will return

:TX_PCM:CONFIGURE:AIS OFF

or

:TX_PCM:CONFIGURE:AIS ON

The TX_PCM:CONFIGURE:AIS part of the returned data is controlled by the HEADER command, see the Advanced Commands Section.

DECnr1

(OUT_FORMAT DECIMAL)

TX_PCM:CONFIGURE:AIS?

will return

:TX_PCM:CONFIGURE:AIS 1

Note **Nr1 decimal is equivalent to integer.**

DECnr2

(OUT_FORMAT FLOAT_POINT)

RX_INFO:PCM:FREQ(?)

will return

:RX_FREQ 2047998.000000

Note **See SIG_DIGITS command for number of decimal places.**

DECnr3

(OUT_FORMAT FIXED_POINT)

RX_INFO:PCM:FREQ(?)

will return

:RX_FREQ 2.047998E+06

Note **See SIG_DIGITS command for number of decimal places.**

Hexadecimal

(OUT_FORMAT HEX)

Data can be returned in hex format TX_PCM:SIGNAL:SIG_CODE?

:TX_PCM:SIGNAL:SIG_CODE #HA

Octal

(OUT_FORMAT OCTAL)

Data can be returned in octal format TX_PCM:SIGNAL:SIG_CODE?

:TX_PCM:SIGNAL:SIG_CODE #Q12

Binary

(OUT_FORMAT BINARY)

Data can be returned in binary format TX_PCM:SIGNAL:SIG_CODE?

:TX_PCM:SIGNAL:SIG_CODE #B1010

Definite

This data type is not returned from the 2851.

Indefinite

This data type is not returned from the 2851.

String

(OUT_FORMAT STRING)

Data can be returned in string format from two types of request,

binary equivalent	TX_PCM:SIGNAL:SIG_CODE?
will return	:TX_PCM:SIGNAL:SIG_CODE "00001010"
or real string	STORE:NAME? 1
will return	:STORE:NAME 1,"X21 BAL DCE"

Arbitrary ascii

Returns an ASCII string(s).

*IDN?

will return

*IDN IFR, 2851 & 2851S,0,3.0

Note **A query returning an ARBITRARY ASCII data type must be the last query in the message.**

Terminating commands

GPIB

For GPIB operation the command can be terminated by either a line-feed <lf>, by <lf>+<eoi>, or by <eoi> with the last character in the command string.

START<lf>

START<lf>+<eoi>

START+<eoi>

Note **The IEEE488 interface contains a connection dedicated to 'End or Identify' EOI, this is either used as a message terminator or as a strobe in a parallel poll sequence.**

RS-232

For RS-232 operation the command is terminated by a line-feed '<lf>'.

START<lf>

White space characters

White space characters are defined as all ASCII characters in the range 00H-20H inclusive, but excluding linefeed 0AH. For RS-232 some control characters have pre-defined meanings, such as ^Q (11H) and ^S (13H) for flow control. It is recommended that only spaces (20H) and carriage return (0DH) are used as white spaces.

White spaces can be inserted into the commands and data in the places indicated by ↔

↔<:>com<[:com]><?> ↔<data><[↔,↔data]><[↔;↔<:>com<[:com]><?> ↔<data><[↔,↔data]>]>↔term

Replacing numeric data with text

Numeric data can be replaced by text where applicable. This is recommended so that the commands are easily understood, and also so that future command additions are less likely to require modifications to the controlling program.

DISPLAY 1	can be replaced by	DISPLAY TX_MENU
TX_PCM:CONFIGURE:PATTERN 0	" " " "	TX_PCM:CONFIGURE:PATTERN QRSS

Reducing command lengths

Commands can be shortened provided the reduced text is still unique. It should be noted that too much reduction may lead to a conflict in future software updates.

RX_DATA:CONFIGURE:PATTERN USER_MSG	could be reduced to	RX_DA:CON:PAT USER
VOLUME 10	" " " "	VOL 10

Appending commands

The commands can be combined into a single string using a semi-colon ';' as the command separator.

START;*WAI;DELAY 5;INJECT;DELAY 5;STOP;*WAI;RESULTS:OTHERS:PATTERN?

The above sequence will run a test for approximately 10 seconds, inject an error after 5 seconds, and return the test pattern errors and ratio.

Appending of complex commands, such as the following, can reduce the amount of data to and from the controller.

TX_PCM:CONFIGURE:PATTERN PRBS<lf>
TX_PCM:CONFIGURE:PRBS_LEN TWO_20<lf>
TX_PCM:CONFIGURE:PRBS_SENSE INVERT<lf>

can be combined as

TX_PCM:CONFIGURE:PATTERN PRBS;PRBS_LEN TWO_20;PRBS_SENSE INVERT<lf>

Typical send/receive sequence

GPIB

The following example illustrates a typical send and receive sequence with the 2851 set to address 4 and the controller to address 0. (The controller address is normally fixed with a switch, most often to 0. For this reason 0 is normally to be avoided by the 2851 so no conflicts occur).

To send "date?" and receive the reply, the commands might be:-

```
send_gpib (4, "DATE?");
receive_gpib (4, ascii_string);
```

The bus sequence would typically be:-

REN	ATN	DATA	EOI	MEANING
1	-	--	-	no activity
1	-	--	-	"
1	-	--	-	"
1	1	63	0	Unlisten
1	1	64	0	Talk address 0 (Controller to talk)
1	1	36	0	Listen address 4 (2851 to listen)
1	0	'd'	0	
1	0	'a'	0	"date?"
1	0	't'	0	
1	0	'e'	0	
1	0	'?'	1	EOI with last data byte
1	1	63	0	Unlisten
1	1	32	0	Listen address 0 (Controller to listen)
1	1	68	0	Talk address 4 (2851 to talk)
1	0	--	-	Small delay while reply formatted.
1	0	'9'	0	
1	0	'3'	0	
1	0	','	0	
1	0	'1'	0	"93,1,18"
1	0	','	0	
1	0	'1'	0	
1	0	'8'	0	
1	0	LF	1	EOI with LF terminator
1	1	95	0	Untalk
1	-	-	-	no activity Note the controller is still listening
1	-	-	-	"
1	-	-	-	"

Note

The handshaking of the data is handled by the GPIB hardware in both the controller and the 2851. This allows the transfer of information automatically to be adjusted to the slowest device on the bus.

RS-232

To send "date?" and then receive the reply for an RS232 link the commands might be:-
send_rs232 ("DATE?")
receive_rs232 (ascii_string)

Rx(3)	Tx(2)	MEANING
-	-	
-	-	
^A	-	Enter 'REMOTE'.
-	-	
'd'	-	
'a'	-	
't'	-	"date?"
'e'	-	
'?'	-	
LF	-	LF terminator
-	-	Small delay while reply formatted.
-	'9'	
-	'3'	Reply from 2851.
-	','	
-	'1'	"93,1,18"
-	','	
-	'1'	
-	'8'	
-	LF	LF terminator.
-	-	
^D	-	Leave 'REMOTE'.
-	-	
-	-	

Special GPIB controls

GOTO LOCAL (GTL, ATN+data=01H)
Places the addressed 2851 into local.
SELECTIVE DEVICE CLEAR (SDC, ATN+data=04H)
The addressed 2851 clears the input buffer and output queues and resets the command decoder.
GROUP EXECUTE TRIGGER (GET, ATN+data=08H)
Executes macro 1.
LOCAL LOCKOUT (LLO, ATN+data=11H)
The 2851 enters the local lockout states.
DEVICE CLEAR (DCL, ATN+data=14H)
Equivalent to SDC except the 2851 does not have to be addressed.
SERIAL POLL ENABLE (SPE, ATN+data=18H)
SERIAL POLL DISABLE (SPD, ATN+data=19H)
Part of the serial poll sequence normally handled automatically by the controller, using a dedicated function.

Note **To exit the local lockout states either remove the remote enable line (REN) or power on (PON).**

Special RS-232 control characters

^A	Connect. The 2851 enters remote.
^D	Disconnect. The 2851 leaves the remote state.
^E	Request data. The 2851 will send the query return message data.
^H	Group execute trigger. Executes macro 1.
^P	Remove Local lockout. Enable front panel LOCAL control.
^Q	X-ON Software handshake, continue sending.
^R	Local lockout. Disable front panel LOCAL control.
^S	X-OFF Software handshake, stop sending.
^T	Device clear. The 2851 clears the input buffer and output queues and resets the command decoder.
^X	Serial poll. The 2851 returns the status byte.
Esc	Ignore character The 2851 will take the next character without checking for a control character.

Note **Power on (PON) also clears the local lockout states.**

Advanced features

Formatting commands

OUT_FORMAT

BINARY	Returned data will be in binary format #B....
OCTAL	Returned data will be in octal format #Q....
DECIMAL	Returned data will be in integer decimal (NR1) format.
FLOAT_POINT	Returned data will be in floating point decimal (NR2)format. n.nnnnnn
FIXED_POINT	Returned data will be in fixed point decimal (NR3) format. n.nnnnnnE±n
HEX	Returned data will be in hexadecimal format #H....
ALPHA	Returned data will be in text format.
STRING	Returned data will be in string format "..."
DEFAULT	The returned data type will use the default type. See table in APPENDIX. A

Note **If the type selected by OUT_FORMAT is not compatible with the command requested the DEFAULT data type is used.**

FORMAT

OFF	No embedded <cr><lf>'s or spacing.
ON	Compound commands have a <cr><lf> appended to each ';', additional spacing is used to align the sub commands.

Note **The spacing is determined by the HEADER selection. HEADER MINIMUM gives spacing.**

FORMAT ON;HEADER MINIMUM;SIG_DIGITS 3;RESULTS:OTHER?

returns

:RESULTS:OTHERS:CODE 0,0.000E+00;
PATTERN 2,3.300E-08

FORMAT ON;HEADER FULL;SIG_DIGITS 3;RESULTS:OTHER?

returns

:RESULTS:OTHERS:CODE 0,0.000E+00;
:RESULTS:OTHERS:PATTERN 2,3.300E-08

MINIMUM The returned commands and alpha data are reduced to the minimum allowed for retransmission to the 2851.

FORMAT MINIMUM;HEADER MINIMUM;OUT_FORMAT DEFAULT;USER_OPTIONS?

returns

:U:C 0;LA 0;V 1;LE 1.000000E-09;E 0

HEADER

OFF No header returned, only the data. This is most useful when requesting results or status information as it reduces the amount of data to the controller.

Note **This can give meaningless information if a multilevel command is requested. eg TEST? will return different data depending on which items are relevant for each of the sub commands.**

MINIMUM The returned commands have the minimum command sequence which can be retransmitted to the 2851.

FULL The returned commands have the full command path for each selection.

DEFAULT The returned commands will use the default header settings.
See COMMAND FORMATS section, page 4-97.

Program Synchronization

*OPC

Operation complete. IEEE488.2 common command used to indicate when the 2851 has completed all previous commands. When all commands have been actioned the OPC bit in the Event Status Register is set.

*OPC?

Operation complete query. IEEE488.2 common command used to indicate when the 2851 has completed all previous commands. When all commands have been actioned the output queue is loaded with a value of 1.

Note **The command header *OPC is returned depending on the setting of HEADER.**

*WAI

Wait to continue command. IEEE488.2 common command, used to indicate when the 2851 has completed all previous commands. This command is not completed until all previous commands have been actioned, this has the effected of blocking the decoding sequence until all commands are completed.

Note ***OPC, *OPC? and *WAI can not be used to determine when the transmitter and receiver hardware has reached a steady state.**

The stopping and starting of a test, synchronized to the one second of the real time clock, are covered by these commands.

DELAY

This command can be used to insert a delay into the decoding sequence. This can be used as a quick and easy way of making sure the Rx and Tx has had time to reach a stable state.

Macros

MS Macro set / show command.

MS 1,"results:performance:per_efs?;per_ses?;per_bad_min?;per_avail?"

Note **The command syntax is only checked when the macro is executed**

MS? 1

returns

:MS "results:performance:per_efs?;per_ses?;per_bad_min?;per_avail?"

ME Macro execute command.

ME 1 Execute macro 1

MC Macro clear command.

MC 1 Clear macro 1

MC 0 Clear all macros.

Macros are intended for the execution of repeated commands to reduce data flow between controller and 2851. This is particularly useful for low speed RS-232 links.

Status reporting summary registers

IEEE488.2 registers	Measurement registers	Tx and Rx registers	Mux/Demux registers	Diagnostic registers
*ESR	ME_SUMMARY	TXRX_SUMMARY	MUX_SUMMARY	IE_SUMMARY
*ESE	ME_MASK	TXRX_MASK	MUX_MASK	IE_MASK

The summary registers and masks can be used for easy identification of events which can generate a service request (SRQ) on a GPIB controller. Setting a bit in a given mask will result in the relevant bit in the status byte being set when the given event occurs. If the corresponding bit in the Service Request Enable (SRE) register is set, then the Master Summary Status (MSS) bit of the status byte (bit 6) will be set. This will generate an SRQ if bit 6 in the SRE register is set.

Existing command

For backward compatibility the following commands exist in two different forms, but are not repeated in this manual.

(Old) Command	(New) Command
ALARMS_LOCK	ALARMS:PCM:LOCK or ALARMS:DATA:LOCK
ALARMS_NOW	ALARMS:PCM:NOW or ALARMS:DATA:NOW
ALARMS_RESET	ALARMS:PCM:RESET or ALARMS:DATA:RESET
RES_BITSLIPS	RESULTS:BITSLIPS
RES_BURSTS	RESULTS:BURSTS
RES_MAJOR	RESULTS:MAJOR
RES_OTHERS	RESULTS:OTHERS
RES_PERF	RESULTS:PERFORMANCE
RES_SLIPS	RESULTS:SLIPS
RES_SYNC	RESULTS:SYNC
RX	RX_PCM:CONFIGURE
RX_LINE	RX_PCM:LINE
RX_SIGNAL	RX_PCM:SIGNAL
TX	TX_PCM:CONFIGURE
TX_LOOPBACK	TX_PCM:LOOPBACK
TX_SEQUENCE	TX_PCM:SEQUENCE
TX_SIGNAL	TX_PCM:SIGNAL
TEST_LIMITS	TEST:LIMITS
TEST_PARAMS	TEST:PARAMETERS
TEST_PROG	TEST:PROGRESS
TEST_SETUP	TEST:SETUP
RX_CHAR_RATE	RX_INFO:DATA:CHAR_RATE
RX_DATA:CTRL_DELAY	RX_INFO:DATA:CTRL_DELAY
RX_DATA:CTRL_LINES	RX_INFO:DATA:CTYRL_LINES
RX_DEMUX:ALARMS_2M: . . .	ALARMS:DEMUX_2M: . . .
RX_DEMUX:ALARMS_34M: . . .	ALARMS:DEMUX_34M: . . .
RX_DEMUX:ALARMS_8M: . . .	ALARMS:DEMUX_8M: . . .
RX_DEMUX:FREQ_2M: . . .	RX_INFO:DEMUX:FREQ_2M

RX_DEMUX:FREQ_34M: . . .	RX_INFO:DEMUX:FREQ_34M
RX_DEMUX:FREQ_8M: . . .	RX_INFO:DEMUX:FREQ_8M
RX_DEMUX:OFFSET_2M: . . .	RX_INFO:DEMUX:OFFSET_2M
RX_DEMUX:OFFSET_34M: . . .	RX_INFO:DEMUX:OFFSET_34M
RX_DEMUX:OFFSET_8M: . . .	RX_INFO:DEMUX:OFFSET_8M
RX_DEMUX:OVERHEAD	RX_INFO:DEMUX:OVERHEAD
RX_FREQ	RX_INFO:DATA:FREQ or RX_INFO:PCM:FREQ
RX_OFFSET	RX_INFO:DATA:OFFSET or RX_INFO:PCM:OFFSET
RX_STATE	RX_INFO:DATA:STATE or RX_INFO:PCM:STATE
RX_OVERHEAD	RX_INFO:PCM:OVERHEAD
RX_WORD	RX_INFO:DATA:WORD or RX_INFO:PCM:WORD
TX_MUX_OVER	TX_PCM:MUX_OVERHEAD
TX_OVERHEAD	TX_PCM:OVERHEAD
TX_STATE	TX_INFO:DATA: . . . or TX_INFO:PCM: . . .

Programming examples

```
/*******************************************************/
/* Use of macro to read results after each results update.              */
/*******************************************************/

void test1 (void)

{

 unsigned char status_byte;
 char *buff_ptr;
 float code_ratio;
 float pattern_ratio;
 float crc_ratio;
 unsigned long code_errors;
 unsigned long pattern_errors;
 unsigned long crc_errors;
 unsigned long count;

  dcl ();                                                  /* Device Clear                                   */
  send_string ("MC 0");                                    /* Clear all macros.                              */
  send_string ("*RST;*CLS;*OPC?);                          /* Reset 2851 to known state.                     */
  read_string (FALSE);                                     /* Wait for operation complete                    */
  send_string ("rx_pcm:configure:system S2MCRC");          /* Set up Rx system.                              */
  send_string ("tx_off;tx_pcm:configure:system S2MCRC;tx_on"); /* Set up Tx system.                          */
  send_string ("delay 3");                                 /* Wait 3 seconds for hardware to initialize.*/
  send_string ("me_mask #h8000;*sre 0");                   /* Set me_mask to 'see' new results update.*/
  send_string ("ms 1,'results:other:code?;pattern?;crc?' "); /* Set macro 1 to return required results.    */
  send_string ("start");                                   /* Start test.                                    */
  count = 1;
  while (count LE 100)                                     /* Loop for 100 seconds.                          */
  {
    do
    {
      status_byte = spoll ();                              /* Serial poll status byte.                       */
    }                                                      /* Wait until a new set of results are            */
    while ((status_byte & 0x02) == 0);                     /* available.  (Once a second)                    */
    send_string ("me_summ?");                              /* Clear the measurement summary register to*/
    buff_ptr = read_string (FALSE);                        /* clear bit 1 in the status byte.                */
    send_string ("me 1");                                  /* Execute macro 1 to return results.             */
    buff_ptr = read_string (FALSE);                        /* Don't echo response.                           */
    sscanf (buff_ptr,                                      /* Convert data.                                  */
            "%lu,%e;%lu,%e;%lu,%e",
            &code_errors,
            &code_ratio,
            &pattern_errors,
            &pattern_ratio,
            &crc_errors,
            &crc_ratio);
    count ++;
  }
  send_string ("stop");                                    /* Stop test.                                     */
}
```

```
/*****************************************************/
/* Test to inject an error after 1 second of a 5 second test, error to   */
/* give rise to SRQ on GPIB bus.                                          */
/*****************************************************/

void test2 (void)

{

  char *buff_ptr;
  unsigned int meas_summary;

   dcl ();                                                   /* Send device clear.                              */
   send_string ("*RST;delay 3");                             /* Reset 2851 and wait 3 secs for hardware.   */
   send_string ("format off;header off");
   send_string ("TEST:PARAMETERS:LENGTH TIMED");
   send_string ("TEST:PARAMETERS:TERM_AFTER 00,00,05");/* Set test length to 5 secs.                */
   send_string ("disp res_other");                           /* Select RESULTS-OTHER ERRORS page.*/
   send_string ("tx_err:status en;mode manual;target pattern");  /* Set tx error injection.          */
   send_string ("me_mask #h2;*sre 66");                      /* ME_ register bit 1, status byte bits 1 & 6.  */
   send_string ("*cls");                                     /* Clear status registers.                     */
   send_string ("start;*WAI;delay 1");                       /* Start test, sync to RTC, delay 1 sec.       */
   send_string ("inject");                                   /* Injection of error pulls SRQ line.          */
   do

   {
      send_string ("me_summ?");                              /* Read measurement summary register.      */
      while ((spoll () & 0x10) == 0)                         /* Wait until MAV bit set in status byte.     */
      {
      }
      buff_ptr = read_string (FALSE);                        /* Do not echo response.                    */
      sscanf (buff_ptr, "%u", &meas_summary);                /* Convert data.                             */
   }
      while ((meas_summary & 0x80) == 0);                    /* Wait until test is completed.              */

}


/*****************************************************/
```

Command layout

Layout	Interpretations	Example
COMMAND	COMMAND	START
COMMAND?	COMMAND?	DEV_ERROR?
COMMAND(?)	COMMAND data or COMMAND?	ME_MASK 1 ME_MASK?
COMMAND? SUB1_COM	COMMAND? COMMAND:SUB1_COM	ERR_DIST? ERR_DIST:INC_MIN
COMMAND? SUB1_COM?	COMMAND? COMMAND:SUB1_COM?	ERR_DIST? ERR_DIST:ERR_MINS?
COMMAND? SUB1_COM(?)	COMMAND? COMMAND:SUB1_COM data COMMAND:SUB1_COM?	TX_ERROR? TX_ERROR:STATUS ENABLE TX_ERROR:STATUS?
COMMAND? SUB1_COM?	COMMAND? COMMAND:SUB1_COM?	RX_PCM? RX_PCM:LINE?

SUB2_COM?	COMMAND:SUB1_COM:SUB2_COM?	RX_PCM:LINE:LEVEL?
COMMAND?	COMMAND?	TEST?
SUB1_COM?	COMMAND:SUB1_COM?	TEST:LIMITS?
SUB2_COM(?)	COMMAND:SUB1_COM:SUB2_COM data	TEST:LIMITS:TYPE USER
	COMMAND:SUB1_COM:SUB2_COM?	TEST:LIMITS:TYPE?
COMMAND?	COMMAND?	RESULTS?
SUB1_COM?	COMMAND:SUB1_COM?	RESULTS:DEMUX_34M
SUB2_COM?	COMMAND:SUB1_COM:SUB2_COM?	RESULTS:DEMUX_34M: ERRORS?
SUB3_COM?	COMMAND:SUB1_COM:SUB2_COM: SUB3_COM?	RESULTS:DEMUX_34M: ERRORS:FRAME_BIT?

Command data types

COMMAND(?) b1,b2,	Each bit in b1,b2,... has an individual significance.
COMMAND(?) n1,n2,	Decimal integers.
COMMAND(?) 0 or OFF 1 or ON	Menu selection in either text or number form.
COMMAND(?) s	String parameter in either single '...' or double "..." quotes.
COMMAND(?) f	Decimal number floating or fixed point.
COMMAND(?) r	Ratio in the form xE±y
COMMAND(?) p	Percentage value between 0% and 100%

GPIB interface

It is assumed that the operator is familiar with the general programming concepts and procedures of the GPIB bus as set out in IEEE standard 488-1978 and IEC Publication 625-1.

GPIB talker/listener capabilities

The interface, which conforms to the IEEE 488 is a talker/listener/controller with the following capabilities:-

SH1 : Source handshake (complete capability)

The source handshake sequences the transmission of each data byte from the instrument over the bus data lines. The sequence is initiated when the function becomes active. The purpose of the function is to synchronize the rate at which bytes become available to the rate at which accepting devices on the bus can receive the data.

AH1 : Acceptor handshake (complete capability)

The acceptor handshake sequences the reading of the data byte from the bus data lines.

T5 : Talker function (complete capability)

The talker function provides the 2851 & 2851S with the ability to send device dependant messages over the bus to other devices. The ability of any device to talk exists only when it has been addressed as a talker.

L4 : Listener function (no listen only function)

The listener function provides the 2851 & 2851S with the ability to receive device dependant messages over the bus. The capability only exists when the device is addressed to listen via the bus controller.

SR1 : Service request function (complete capability)

The service request function gives the 2851 & 2851S the capability to inform the controller when it requires attention.

RL1 : Remote/local function (complete capability)

The remote/local function allows the 2851 & 2851S to be controlled by its front panel keys and by device dependant messages over the bus. The 2851 & 2851S can also be locked out.

DC1 : Device clear function (complete capability)

Device clear (DCL) is a general reset and may be given to all devices in the system simultaneously.

PP0 : Parallel poll (No capability)

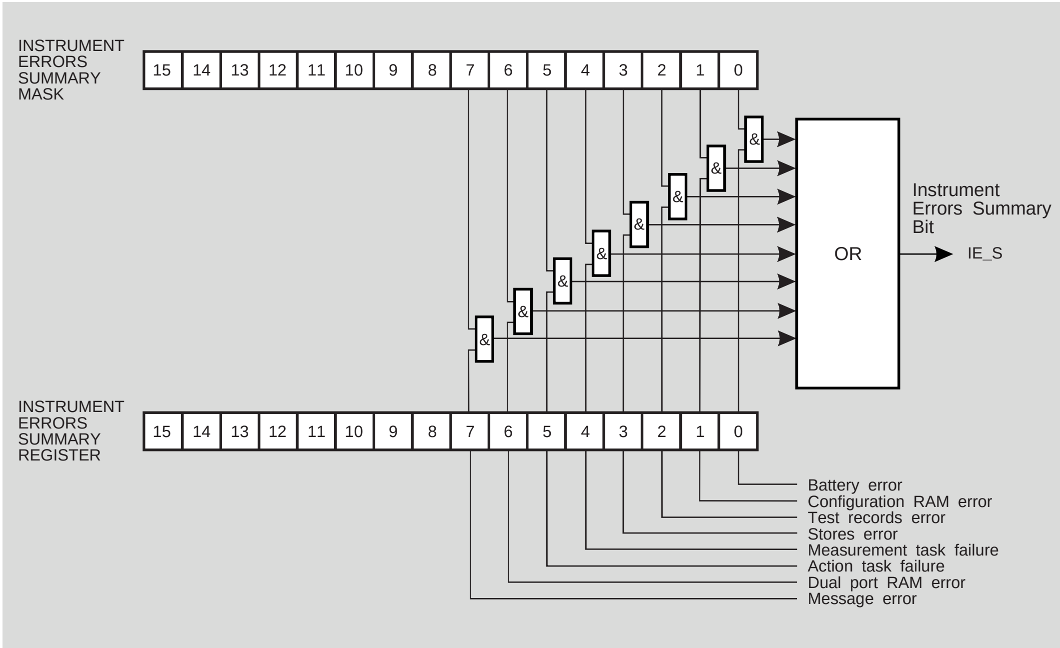
DT1 : Device Trigger (complete capability)

C0 : Controller (No capability)

See printer section for GPIB printing capability.

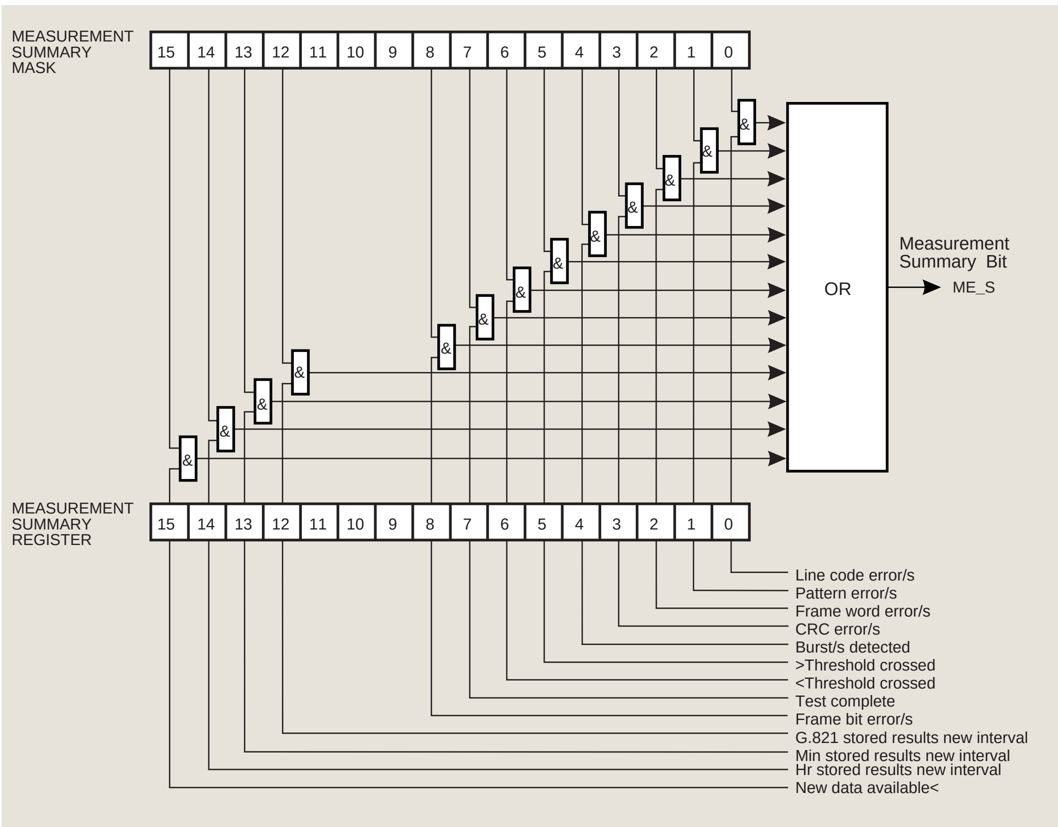
For addressed printer C1, C2, C3, C28.

For listen only - C0.



C2122

Fig. 4-5 Instrument errors summary register and mask



C1439

Fig. 4-6 Measurement summary register and mask

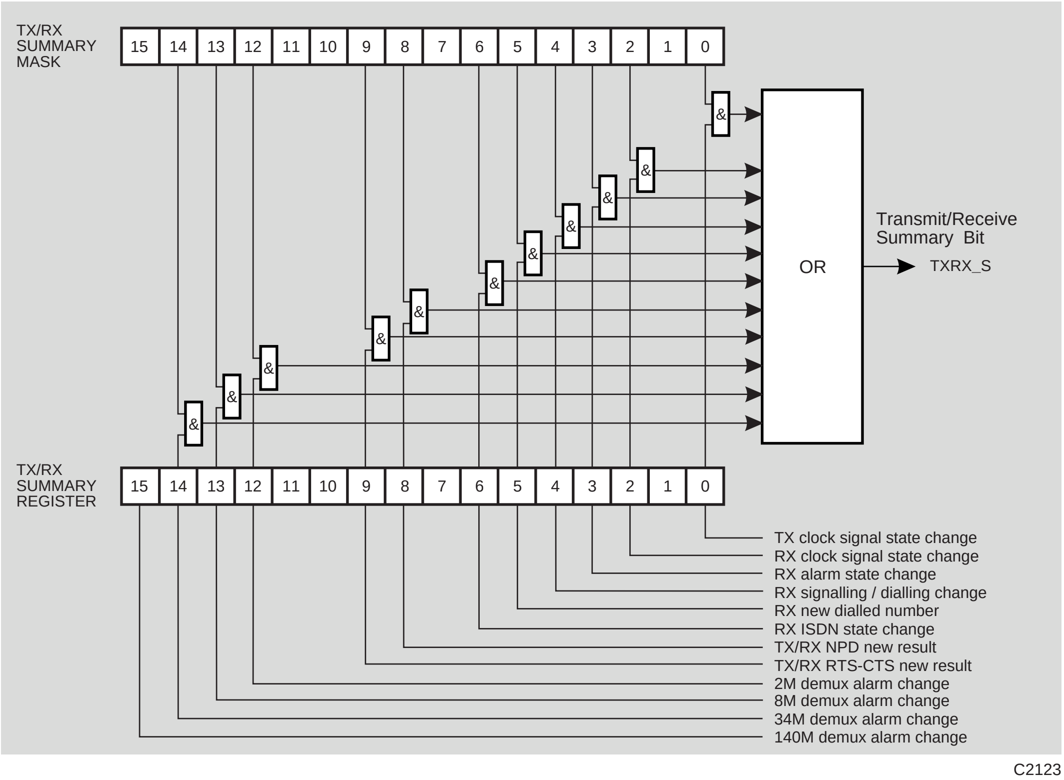


Fig. 4-7 Tx/Rx Summary register and mask

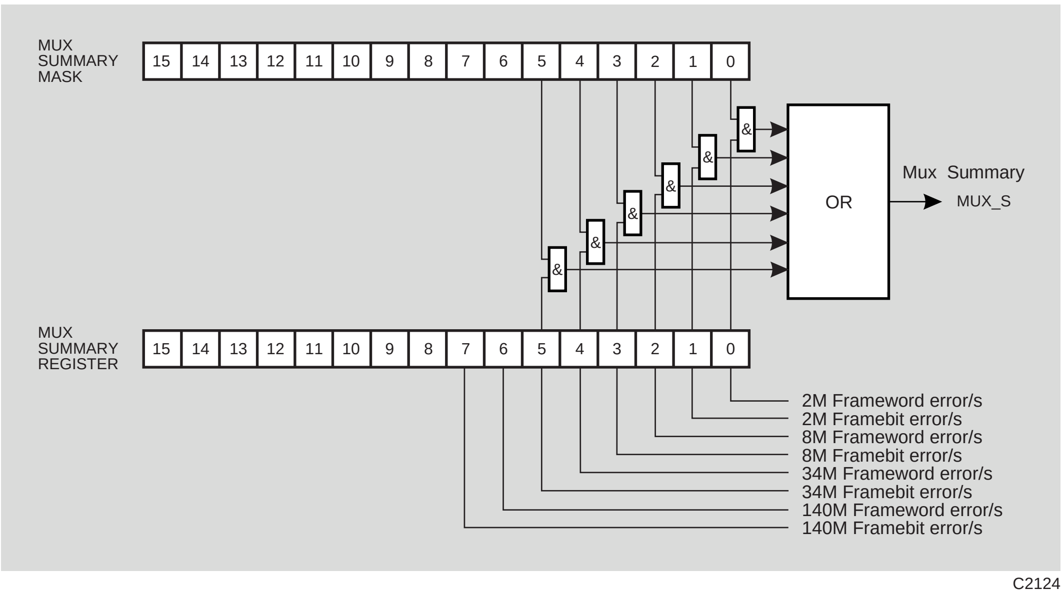


Fig. 4-8 Mux Summary register and mask

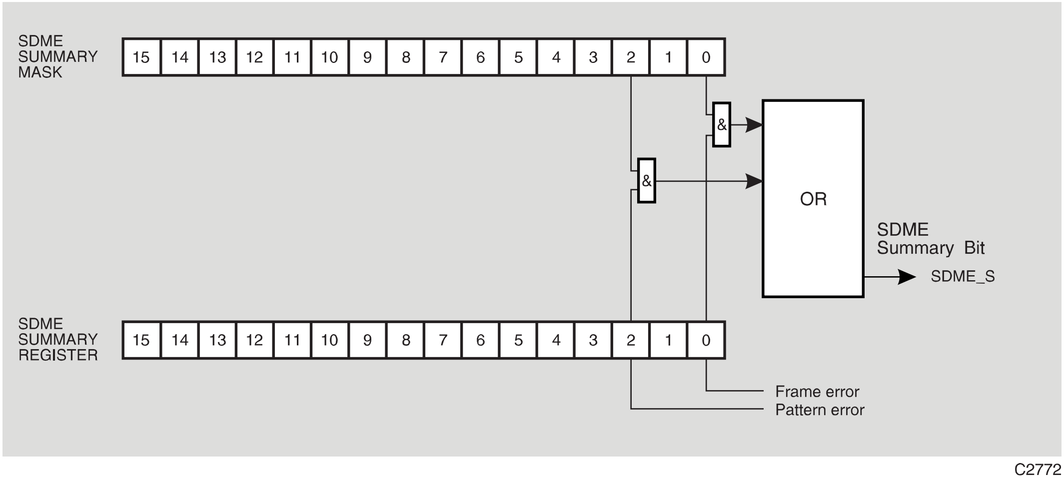


Fig. 4-9 SDME Summary register and mask

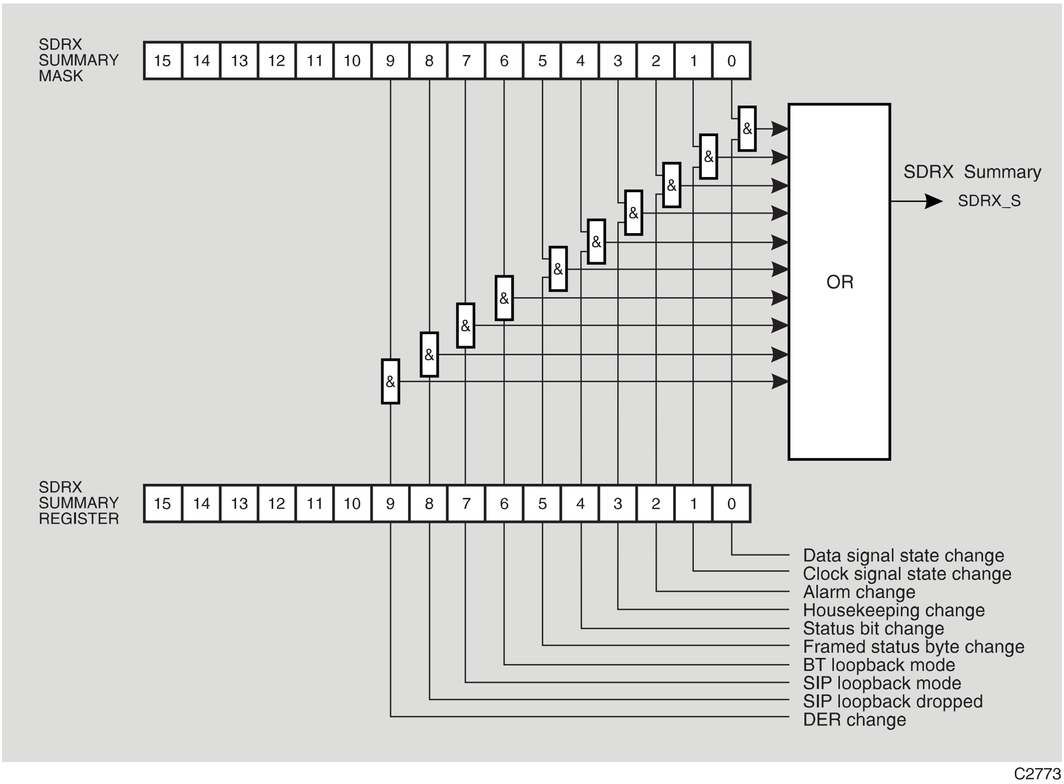


Fig. 4-10 SDRX Summary register and mask

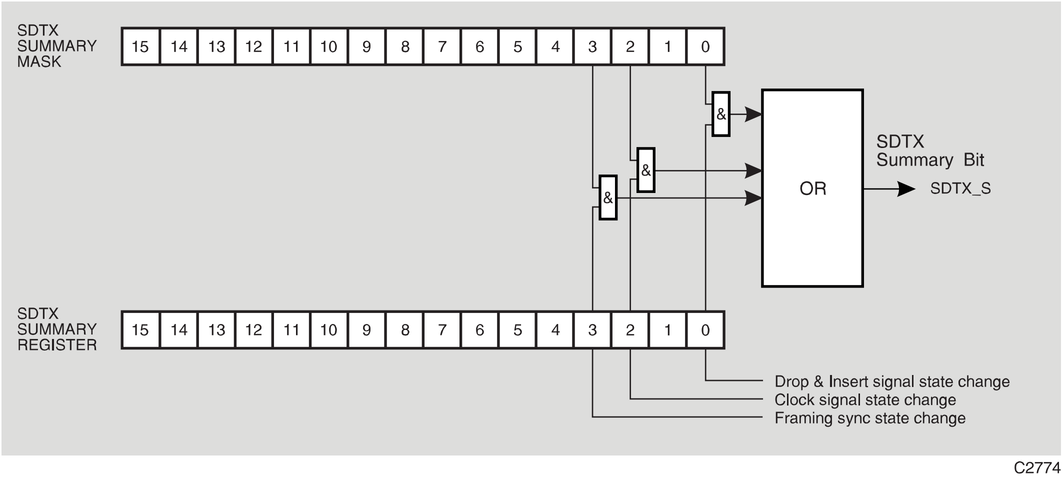


Fig. 4-11 SDTX Summary register and mask

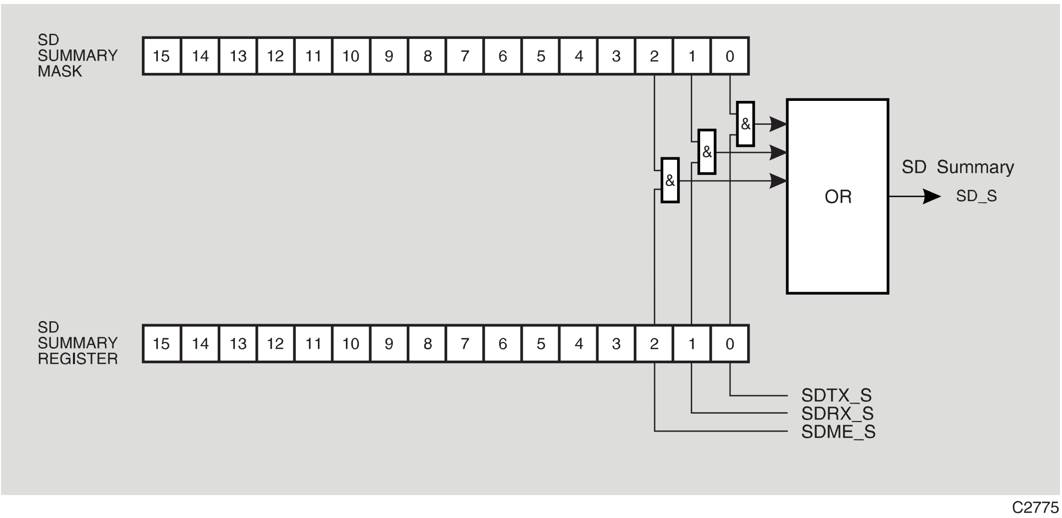


Fig. 4-12 SD Summary register and mask

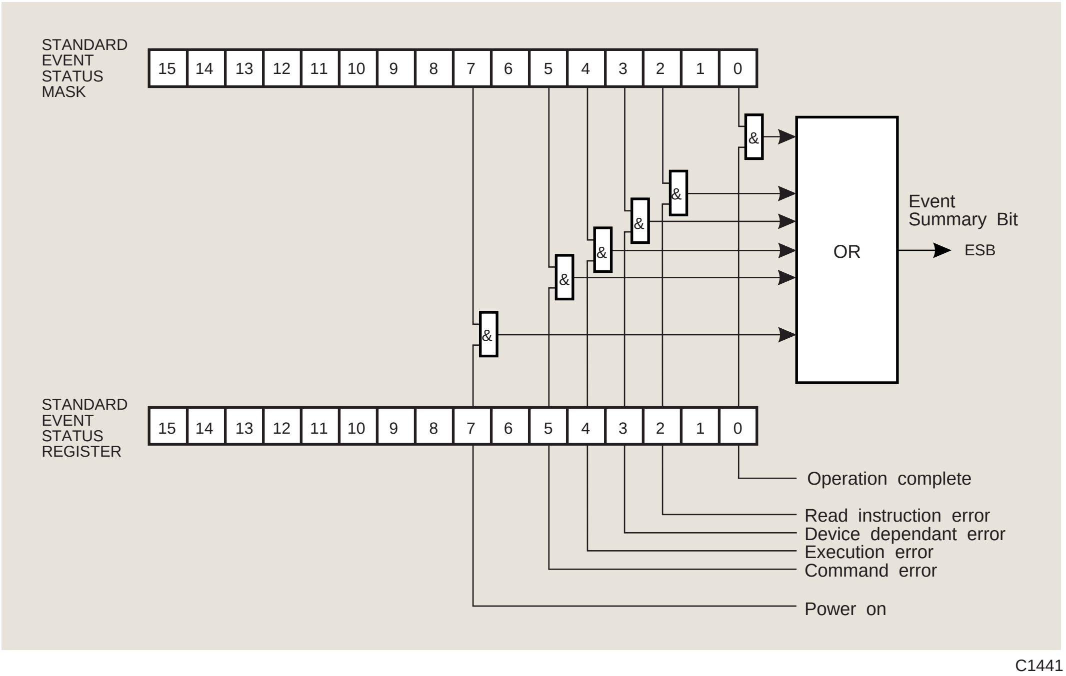


Fig. 4-13 Event status register and mask

Status byte Bit 6 is read as MSS if status byte is read by a *STB? common command or is read as RQS if status byte is read by a serial poll. RQS is cleared after poll.

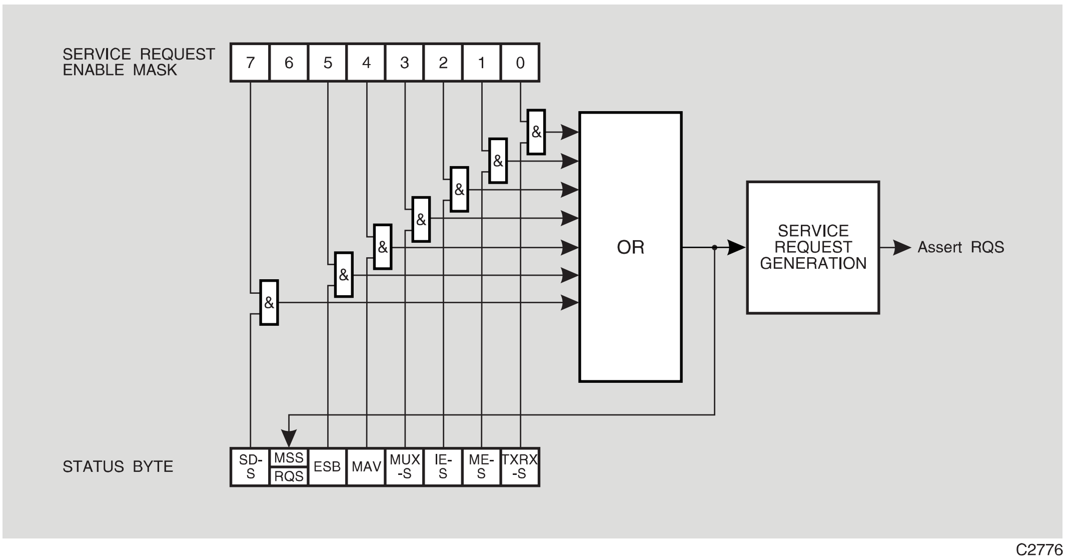


Fig. 4-14 Status byte and Service request enable mask

Command definitions

COMMAND **DESCRIPTION**

```
ALARMS?
        DATA?
                  LOCK?
             b
          Bit 0   = Line
             1   =
             2   =
             3   =
             4   =
             5   =
             6   =
             7   =
             8   =
             9   =
             10  = Pattern sync
             11  = -
             12  = Errors
             13  =
             14  =
             15  = -

NOW?
RESET?

DEMUX_140M?
        LOCK?
             b
          Bit 0   = Line
             1   = AIS
             2   = Frame
             3   =
             4   = Distant
             5   =
             6   =
             7   =
             8   =
             9   =
             10  =
             11  = -
             12  = Errors
             13  =
             14  =
             15  = -

NOW?
RESET?
```

DEMUX_34M?
LOCK?
b

Bit	0	= Line
	1	= AIS
	2	= Frame
	3	=
	4	= Distant
	5	=
	6	=
	7	=
	8	=
	9	=
	10	= Pattern sync
	11	= -
	12	= Errors
	13	=
	14	=
	15	= -

NOW?
RESET?

DEMUX_8M?
LOCK?
b

Bit	0	= Line
	1	= AIS
	2	= Frame
	3	=
	4	= Distant
	5	=
	6	=
	7	=
	8	=
	9	=
	10	= Pattern sync
	11	= -
	12	= Errors
	13	=
	14	=
	15	= -

NOW?
RESET?

DEMUX_2M?
LOCK?
b
Bit 0 = Line
1 = AIS
2 = Frame
3 = Multiframe
4 = Distant
5 = Distant MF
6 =
7 =
8 = Multiframe due to 64 kbit/s AIS
9 = CRC_MF
10 = Pattern sync
11 = -
12 = Errors
13 =
14 = C-bit framing alarm
15 = -

NOW?
RESET?

PCM?
LOCK?
b
Bit 0 = Line
1 = AIS
2 = Frame
3 = Multiframe
4 = Distant
5 = Distant MF
6 = Yellow
7 = Excess zeros
8 = Multiframe due to 64 kbit/s AIS
9 = CRC MF
10 = Pattern sync
11 = -
12 = Errors
13 = T1ESF Yellow
14 = C-bit framing alarm
15 = -

NOW?
RESET?

SDATA?
LOCK?
b
Bit 0 = Line
1 = AIS
2 = Frame
3 =
4 =
5 =
6 =
7 =
8 =
9 =
10 = Pattern sync
11 = -
12 = Errors
13 =
14 =
15 = -

NOW?
RESET?

AUTO_PRINT **Set or Read Auto Print parameters.**

AUTO_PRINT?
EVENT? Configure Event print.
STATUS(?)
0 *or* OFF
1 *or* ON
ALARMS(?)
0 *or* NO
1 *or* YES
ERRORED_SECS(?)
0 *or* NO
1 *or* YES
SIGNALLING(?)
0 *or* NO
1 *or* YES
RATIO(?)
r
THRESHOLD(?)
0 *or* NO
1 *or* YES
PERF_LIMITS(?)
0 *or* NO
1 *or* YES

INTERVAL? — Configure Interval print.

STATUS(?)
- 0 *or* OFF
- 1 *or* ON

TIME(?)
- 0 *or* T15_MINS
- 1 *or* T30_MINS
- 2 *or* T1_HOUR
- 3 *or* T6_HOURS
- 4 *or* T12_HOURS
- 5 *or* T24_HOURS

MAJOR_ERRORS(?)
- 0 *or* NO
- 1 *or* YES

OTHER_ERRORS(?)
- 0 *or* NO
- 1 *or* YES

DEMUX_ERRORS(?)
- 0 *or* NO
- 1 *or* YES

SDATA(?)
- 0 *or* NO
- 1 *or* YES

G821(?)
- 0 *or* NO
- 1 *or* YES

G826(?)
- 0 *or* NO
- 1 *or* YES

STORED_RES(?)
- 0 *or* NO
- 1 *or* YES

SYNC_SLIPS(?)
- 0 *or* NO
- 1 *or* YES

BRQ_CHAR — **Set or read the RS232 byte request character status.**

BRQ_CHAR(?)
- 0 *or* ON
- 1 *or* OFF

COMM_ERROR — **Read the last command error.**

COMM_ERROR?

n

0 = No error.
1 = Illegal star(*) command.
2 = The sub<sub>command is not allowed for current <sub>command.
3 = Unrecognised <sub>command mnemonic.
4 = The <sub>command mnemonic is not unique.
5 = A parameter is not allowed with a write only command.
6 = The read function if not allowed with the command mnemonic.
7 = Illegal format, the parser could not decode the input.
Note...The error is cleared on reading.

CONFIG_SIG — **Set or Read the signalling parameters.**

CONFIG_SIG?

BREAK_MIN(?)		
	n	Pulse break minimum value (ms).
BREAK_MAX(?)		
	n	Pulse break maximum value (ms).
MAKE_MIN(?)		
	n	Inter-pulse break minimum value (ms).
MAKE_MAX(?)		
	n	Inter-pulse break maximum value (ms).
PAUSE_MIN(?)		
	n	Inter-digit pause minimum value (ms).
BREAK_CODE(?)		
	b	Break code contained in 2 or 4-bits.
MAKE_CODE(?)		
	b	Make code contained in 2 or 4-bits.
DIAL_MAPPING(?)		
	0 *or* D_0_9	0-9
	1 *or* D_1_9_0	1-9,0
	2 *or* D_9_0	9-0
	3 *or* D_0_9_1	0,9-1

DATE — **Set or Read the Date.**

DATE(?)

yy,mm,dd
yy = The last two digits of the year (00-99).
mm = The month (01-12).
dd = The day (01-31).

DELAY — **Insert a delay in decoding sequence**

DELAY

n — n second delay.

DEV_ERROR — **Read the last 2851 & 2851S device error.**

DEV_ERROR?

n
0 = No error.
1 = Parameter value was out of range.
2 = Unable to change to the new parameter.
3 = Bar graph cursor out of range.
4 = Page invalid on current setting.
5 = The sub<sub>command is unavailable or the parameter was not compatible with selected sub<sub>command.
6 = The <sub>command is unavailable on current instrument selections (software/hardware).
7 = Macro in use.
Note... The error is cleared on reading.

DISPLAY **Move to the specified page.**

DISPLAY

n		n	
0		53	or PRINT_VIEW
1	or TX_MENU	54	or PRINT_STATUS
2	or TX_SUMMARY	55	
3	or TX_SYSTEM	56	or STATUS
4	or TX_PATTERN	57	or STATUS_SDATA
5	or TX_ERROR	58	or CONF_MENU
6	or TX_NX64	59	or CONF_PORT
7	or TX_CEPT_OVER	60	or CONF_TIME
8	or TX_BELL_OVER	61	or CONF_VERSION
9	or TX_SIGNAL	62	or CONF_OPTION
10	or TX_SEQUENCE	63	or CONF_SWITCH
11	or TX_LOOPBACK	64	or CONF_PRINTER
12		65	or CONF_EVENT
13		66	or CONF_INTERVAL
14		67	or CONF_SIGNAL
15	or RES_MENU	68	or CONF_DEBUG
16	or RES_MAJOR	69	or CONF_VER2
17	or RES_OTHER	70	
18	or RES_PERF	71	or TEST_MENU
19	or RES_ST_HR	72	or TEST_PROG
20	or RES_ST_MIN	73	or TEST_PARAM
21	or RES_DM_HIST	74	or TEST_SETUP
22	or RES_ES_HIST	75	or TEST_LIMITS
23	or RES_SES_HIST	76	or TEST_SD_LOOP
24	or RES_BRK_HIST	77	or TEST_SD_CTRL
25	or RES_SYNC	78	
26	or RES_BURSTS	79	or TX_MUX
27	or RES_SLIPS	80	or TX_MUX_OVER
28	or RES_BIT_SLIP	81	or TX_MUX_SEQ
29	or RES_SDATA	82	
30	or RES_SYNC_SD	83	
31		84	
32	or RX_MENU	85	or RX_MUX
33	or RX_SYSTEM	86	or RX_ALARMS
34	or RX_TEST_PATN	87	or RX_MUX_OVER
35	or RX_NX64	88	or RX_MUX_FREQ
36	or RX_OVERHEAD	89	
37	or RX_SIGNAL	90	
38	or RX_LINE	91	or TXD_MENU
39	or RX_ISDN	92	or TXD_SUMMARY
40	or RX_DELAY	93	or TXD_CODING
41		94	or TXD_CLOCK
42		95	or TXD_PATTERN
43		96	or TXD_LINE
44	or POWER_UP	97	
45	or AUTO_RESTART	98	
46	or SELF_TEST	99	
47		100	RXD_MENU
48	or STORE	101	RXD_SYSTEM
49	or USER_STORE	102	RXD_CODING
50	or FIXED_STORE	103	RXD_PATTERN
51	or TESTS_STORE	104	RXD_LINE
52	or PRINT_STORE	105	

DISPLAY (cont'd) Move to the specified page.

n
106
107
108 or RESX_FRAMING
109 or RESX_G821ES
110 or RESX_G821EFS
111 or RESX_G821TOT
112 or RESX_OTHER
113 or RESX_140SYNC
114 or RESX_34SYNC
115 or RESX_8SYNC
116
117 or TX_SD_MENU
118 or TX_SD_SUMM
119 or TX_SD_CLK
120 or TX_SD_PAT
121 or TX_SD_BITS
122 or TX_SD_DRATE
123 or TX_SD_ERRINJ
124 or TX_SD_STATUS
125 or TX_SD_MISC
126
127 or RES_SD_PAT
128 or RES_SD_FRAM
129 orRES_SD_PERF
130
131
132 or RX_SD_MENU
133 or RX_SD_SYS
134 or RX_SD_CLK
135 or RX_SD_PAT
136 or RX_SD_BITS
137 or RX_SD_DRATE
138 or RX_SD_STATUS
139 or RX_SD_ALARMS
140 or RX_SD_MISC
141
142
143 or TEST_G821_L
144 or TEST_G826_L
145 or TEST_M2100_L
146
147 or TEST_THRESH
148
149
150 or RES_G821_L
151 or RES_G826_L
152 or RES_M2100_L

ERR_DIST Position or Report Error Distribution.

ERR_DIST?	
CURSOR_POS(?)	Set or Read the 'Stored Results' cursor position.
yy,mm,dd,hh,mm	
yy = year	(00-99).
mm = month	(01-12).
dd = day	(01-31).
hh = hour	(00-23).
mm = minute	(00-59).
ERR_TYPE?	Read the associated error type
0 *or* LINE_CODE	
1 *or* PATTERN	
2 *or* FRAME_WORD	
3 *or* FRAME_BIT	
4 *or* FRAME_2M_W	
5 *or* FRAME_2M_B	
6 *or* FRAME_8M_W	
7 *or* FRAME_8M_B	
8 *or* FRAME_34M_W	
9 *or* FRAME_34M_B	
10 or FRAME_140M_W	
11 or FRAME_140M_B	
12 *or* CRC_BLOCK	
13 or S_PATTERN	
14-or S_FRAMING	
ERR_HOURS?	Read the 'Stored Hour Results' at the cursor.
n1,n2,n3	
n1 = no. of errors (0 to 999,999).	
n2 = no. of errored seconds (0 to 3600).	
n3 = no. of severely errored seconds (0 to 3600).	
ERR_MINS?	Read the 'Stored Minute Results' at the cursor.
n1,n2,n3	
n1 = no. of errors (0 to 65,535).	
n2 = no. of errored seconds (0 to 60).	
n3 = no. of severely errored seconds (0 to 60).	
INC_MIN	Increment cursor to next minute.
INC_MIN_15	Increment cursor 15 minutes.
DEC_MIN	Decrement cursor to previous minute.
DEC_MIN_15	Decrement cursor 15 minutes.
INC_HR	Increment cursor to next hour.
INC_HR_15	Increment cursor 15 hours.
DEC_HR	Decrement cursor to previous hour.
DEC_HR_15	Decrement 15 hours.
FIRST(?)	Move to or return first available cursor position.
yy,mm,dd,hh,mm	
LAST(?)	Move to or return last available cursor position.
yy,mm,dd,hh,mm	

STAT_HR ? — Read the hour status at the current cursor.

n1,n2,n3
n1 = 0 - No measurement made.
1 - Measurement made.
n2 = 0 - No sync loss.
1 - Sync loss for all or part.
n3 = 0 - No power fail.
1 - Power fail for all or part.

STAT_MIN ? — Read the minute status at the current cursor.

n1,n2,n3
n1 = 0 - No measurement made.
1 - Measurement made.
n2 = 0 - No sync loss.
1 - Sync loss for all or part.
n3 = 0 - No power fail.
1 - Power fail for all or part.

EXEC_ERROR — **Read the last execution error.**

EXEC_ERROR ?

n
0 = No error.
1 = The data associated with the parameter was of the incorrect type.
2 = Too many parameters were sent for the given <sub>command.
3 = Insufficient parameters were sent for the given <sub>command.
4 = A parameter(s) was needed for the given <sub>command.
5 = Unrecognised alpha text parameter.
6 = The alpha text parameter is not unique.
7 = Unrecognised suffix for this <sub>command-parameter.
8 = Suffix not allowed for this <sub>command-parameter.
Note... The error is cleared on reading.

FORMAT — **Set or Read the returned format.**

FORMAT (?)

0 *or* OFF	returned data is not formatted
1 *or* ON	returned data is formatted.
2 *or* MINIMUM	returns the minimum unique - text. (See Note).

Note

Some 2851 command mnemonics may be changed when its software is updated. Retransmitting stored returned data strings from a 2851 with earlier software to a 2851 with later software could cause operation errors if FORMAT MINIMUM was set before the data was recalled.

G821_HIST	**Position or Report G821 Histograms.**
G821_HIST ?	
CURSOR_POS (?)	Set or Read 'G.821 Results' cursor position.
yy,mm,dd,hh,mm	
yy = year	(00-99)
mm = month	(01-12)
dd = day	(00-31)
hh = hour	(00-23)
mm = minute	(00-59)
ERR_TYPE ?	Read the associated error type.
0 *or* LINE_CODE	
1 *or* PATTERN	
2 *or* FRAME_WORD	
3 *or* FRAME_BIT	
4 *or* FRAME_2M_W	
5 *or* FRAME_2M_B	
6 *or* FRAME_8M_W	
7 *or* FRAME_8M_B	
8 *or* FRAME_34M_W	
9 *or* FRAME_34M_B	
10 or FRAME_140M_W	
11 or FRAME_140M_B	
12 *or* CRC_BLOCK	
13 or S_PATTERN	
14 or S_FRAMNG	
DM_INT_LIM ?	DM error limit for each intervals
n	
DM_INT_TOT ?	DM total errors for interval at cursor position.
n	
DM_PER_LIM ?	DM error limit for total period of all intervals.
n	
DM_PER_TOT ?	DM total errors for total period of all intervals.
n	
ES_INT_LIM ?	ES error limit for each interval.
n	
ES_INT_TOT ?	ES total errors for interval at cursor position.
n	
ES_PER_LIM ?	ES error limit for total period of all intervals.
n	
ES_PER_TOT ?	ES total errors for total period of all intervals.
n	
SES_INT_LIM ?	SES error limit for each interval.
n	
SES_INT_TOT ?	SES total errors for interval at cursor position.
n	
SES_PER_LIM ?	SES error limit for total period of all intervals.
n	
SES_PER_TOT ?	SES total errors for total period of all intervals.
n	
BRK_INT_TOT ?	Break total for interval at cursor position.

	n	
BRK_PER_TOT ?		Break total for total period of all intervals.
	n	
PER_UNAVAIL ?		Percentage unavailable time over total period of all intervals.
	p	
INC		Move cursor to next interval.
DEC		Move cursor to previous interval.
FIRST (?)		Move to or return first available cursor position.
	yy,mm,dd,hh,mm	
LAST (?)		Move to or return last available cursor position.
	yy,mm,dd,hh,mm	
STATUS ?		Read the status at the current cursor position.
	n1,n2,n3	
	n1 = 0 - No measurement made. 1 - Measurement made.	
	n2 = 0 - No sync loss. 1 - Sync loss for all or part.	
	n3 = 0 - No power fail. 1 - Power fail for all or part.	

GPIB_PORT — **Set or Read GPIB port parameters.**

GPIB_PORT ?
- INTERFACE (?)
  - 0 *or* NONE
  - 1 *or* REMOTE
  - 2 *or* PRINTER
- MODE (?)
  - 0 *or* LISTEN_ONLY
  - 1 *or* ADDRESSED
- ADDRESS (?)
  - n

Note **After changing the GPIB parameters a delay of 1 Second is recommended.**

HEADER — **Set or Read the returned header type.**

HEADER (?)

0 *or* OFF	No headers returned
1 *or* MINIMUM	Returns the minimum of headers
2 *or* FULL	Returns the command mnemonic with each parameter header
3 *or* DEFAULT	Uses the default header option applicable to the command mnemonic.

See description on page 4-16

IE_MASK **Set or Read Instrument Errors Summary mask.**

IE_MASK (?)

b

Bit 0 = Battery error.
1 = Configuration Ram error.
2 = Test records error.
3 = Stores error.
4 = Measurement task failure.
5 = Action task failure.
6 = Dual Port RAM error.
7 = Message error.
8-15 = Unassigned

Set a bit to a one to enable reading the equivalent bit in the summary register. (See Fig. 4-5).

Note... Bits 0 to 3 are set on power-up and self-test only.
Bits 4 to 7 indicate an inter-board fault.

IE_MSUMM **Read Instrument Errors Summary register ANDED with IE_MASK.**

IE_MSUMM ?

b

Read only those bits allowed by IE_MASK.
All bits are cleared when the summary is read.

IE_SUMMARY **Read Instrument Errors Summary register.**

IE_SUMMARY ?

b

A bit is set for any of the occurrences.
All bits are cleared when the summary is read. (See Fig. 4-5).
Note... The IE summary bit in status byte register (*STB) will be set (only if IE_MASK is enabled) if either a configuration RAM error or a test record error occurs during self test.

INJECT **Inject single or burst errors.**

INJECT

The injection type is defined by the TX_ERROR and TX_SDATA:ERR_...

ISDN_LOCK **Read Lamp Lock ISDN bits.**

ISDN_LOCK ?

b1,b2,b3,b4

Bit 0 = Errored second
1 = Degraded minutes
2 = Severely errored seconds
3 = Direction indicator (b1 on 2MCnoMF system only)
4-7 = Unassigned

		2MCnoMF	2MnoMF
where	b1 represents	CD->LTor	CD->ET
	b2	NT1->LT	NT1->LT
	b3	LT->NT1	LT->NT1
	b4	NT2->NT1	NT2->NT1

ISDN_NOW **Read Current ISDN bits.**

ISDN_NOW ?

b1,b2,b3,b4

ISDN_RESET **Reset Lamp Lock ISDN bits.**

ISDN_RESET

LAMP_LOCK **Set the Alarms Lamp Lock status.**

LAMP_LOCK

0 *or* OFF
1 *or* ON
Note... This command mirrors the front panel key "LAMP LOCK".

LAST_RESULTS **Read the buffered results.**

LAST_RESULTS?

The results for this command are a copy of the results on the last update boundary. The sub-command format is identical to the RESULTS command.

Note **The buffering of the results occurs on instrument time boundaries, the buffering interval is set by the UPDATE_INT command.**

MC **Clear macro command.**

MC

n	Clear macro n.
n=0-32	n=0 clears all macros.

ME **Execute macro command.**

ME

n	Execute macro n.
n=1-32	

ME_MASK **Set or Read Measurement Summary mask.**

ME_MASK (?)
b
Bit 0 = Line code error/s.
1 = Pattern error/s.
2 = Frame word error/s.
3 = CRC error/s.
4 = Burst/s detected.
5 = > threshold crossed.
6 = < threshold crossed.
7 = Test complete.
8 = Frame bit error/s.
9 = E bit error
10 = Octet slip
11 = Performance limit exceeded
12 = G821 stored results new interval.
13 = Minute stored results new interval.
14 = Hour stored results new interval.
15 = New data available (only if the test is running).

Set a bit to a one to enable reading the equivalent bit in the summary register. (See Fig. 4-6).

ME_MSUMM **Read Measurement Summary register ANDED with ME_MASK.**

ME_MSUMM ?
b
Read only those bits allowed by ME_MASK.
All bits are cleared when the summary is read.

ME_SUMMARY **Read Measurement Summary register.**

ME_SUMMARY ?
b
A bit is set for any of the occurrences.
All bits are cleared when the summary is read or on start of test.
(See Fig. 4-6).

Note **The ME summary bit in status byte register (*STB) will be set (only if ME_MASK is enabled) if errors are detected, thresholds crossed, new data available or test completed.**

MS **Set or Show macro.**

MS(?)

n,s
n=1-32

Note

The total number of characters for all 32 macros is 1024.

Examples

MS 1,'err_dist:inc_min;err_mins?'
Sets macro 1 to increment the stored results cursor and then return the results for that minute.
MS? 32
Returns the command string contained in macro 32.

MUX_MASK **Set or Read Demux Summary mask**

MUX_MASK(?)

b
Bit 0 = 2M Frame word error/s.
1 = 2M Frame bit error/s.
2 = 8M Frame word error/s.
3 = 8M Frame bit error/s.
4 = 34M Frame word error/s.
5 = 34M Frame bit error/s.
6 = 140M Frame word error/s
7 = 140M Frame bit error/s

Set a bit to a one to enable reading the equivalent bit in the summary register. (See Fig. 4-8)

MUX_MSUMM **Read Mux Summary register ANDED with MUX_MASK.**

MUX_MSUMM?

b
Read only those bits allowed by MUX_MASK
All bits are cleared when the summary is read.

MUX_SUMMARY **Read Mux Summary register.**

MUX_SUMMARY?

b
A bit is set for any of the occurrences.
All bits are cleared when the summary is read or on start of test.
(See Fig. 4-8)

OUT_FORMAT	**Set or Read the returned Out Format Option.**
OUT_FORMAT (?)	
0 *or* BINARY	Data output as binary.
1 *or* OCTAL	Data output as octal.
2 *or* DECIMAL	Data output as decimal.(NR 1)
3 *or* FLOAT_POINT	Data output as decimal.(NR 2)
4 *or* FIXED_POINT	Data output as decimal.(NR 3)
5 *or* HEX	Data output as hex.
6 *or* ALPHA	Data output as text.
7 *or* STRING	All 8/16/32 bits of data are output. e.g "00011000" instead of #B11000.
8 *or* DEFAULT	Default to the option applicable to the command mnemonic.

See page 4-15 for further explanation.

Note

NR = Numeric Representation. ANSI X3.42-1975.

(NR 1) = Integer, see Table 4-1 Data type options- page 4-97.

(NR 2) = Floating decimal point xxx.yyy, seeTable 4-1 Data type options, page 4-97.
(See also SIG_DIGITS, page 4-71).

(NR 3) = Fixed decimal point and exponent x.yyyE±nn, see Table 4-1 Data type options page 4- 97.
(See also SIG_DIGITS, page 4-71).

PERCENT_PERF	**Set or Read Performance**
PERCENT_PERF (?)	
0 *or* GOOD_0	0% Good.
1 *or* GOOD_100	100% Good.

POWER_DOWN	**Report Instrument Power Down Time.**

POWER_DOWN ?

yy,mm,dd,hh,mm,ss

yy	= year
mm	= month
dd	= day
hh	= hour
mm	= minute
ss	= second

POWER_UP	**Report Instrument Power Up Time.**

POWER_UP ?

yy,mm,dd,hh,mm,ss

PRINT	**Print screen to local printer.**

PRINT

PRINTER_PORT	**Set or Read Printer Parameters.**
PRINTER_PORT ?	
TYPE (?)	
0 *or* TEXT	
1 *or* GRAPHICS	
TERMINATOR (?)	
0 *or* NONE	
1 *or* CR_ONLY	
2 *or* LF_ONLY	
3 *or* CRLF	
IDENTITY_NO (?)	
n	
LABEL (?)	
s	12 ASCII characters max.

QUE_ERROR	**Read the last query error.**

QUE_ERROR ?

n
0 = No error.
1 = Interrupted i.e. a new command was sent before 2851 & 2851S finished replying.
2 = Unterminated i.e. the command was sent without termination.
3 = Deadlocked i.e. both the Rx and Tx buffers are full.
Note... The error is cleared on reading.

RESULTS	**Read results**
RESULTS ?	
BITSLIPS ?	Read the bit slip error results.
MAIN_FREQ ?	Frequency of received input signal.
f	Hz
SLIP_FREQ ?	Frequency of reference signal.
f	Hz
SLIP_COUNT ?	Number of slips in last second.
n	
SLIP_TOTAL ?	Number of slips since start of test.
n	
BURSTS ?	Read burst error results.
TOTAL ?	Number of bursts.
n	
INTERVAL ?	Interval between bursts.
f	Seconds.
SINCE ?	Time since last burst.
f	Seconds.

MAJOR ?	Read the Major error results.
ERROR_TYPE ?	
0 *or* LINE_CODE	
1 *or* PATTERN	
2 *or* FRAME_WORD	
3 *or* FRAME_BIT	
4 *or* FRAME_2M_W	
5 *or* FRAME_2M_B	
6 *or* FRAME_8M_W	
7 *or* FRAME_8M_B	
8 *or* FRAME_34M_W	
9 *or* FRAME_34M_B	
10 or FRAME_140M_W	
11 or FRAME_140M_B	
12 *or* CRC_BLOCK	
13 or S_PATTERN	
14 or S_FRAMING	
TOTAL_ERRORS ?	Total errors.
n	
MEAN_ERR_RAT ?	Mean error ratio.
r	
CURRENT_RAT ?	Current error ratio.
r	
RESIDUAL_RAT ?	Residual error ratio
r	
OTHERS ?	Read the error results for the other error types.
CODE ?	
n,r	
n = total code errors	
r = code error ratio	
PATTERN ?	
n,r	
n = total pattern errors	
r = pattern error ratio	
FRAME_WORD ?	
n,r	
n = total frame word errors	
r = frame word error ratio	
FRAME_BIT ?	
n,r	
n = total frame bit errors	
r = frame bit error ratio	
CRC ?	
n,r	
n = total crc errors	
r = crc error ratio	
E_BIT?	
n,r	
n = total E-bit errors	
r = E-bit error ratio	

PERFORMANCE ?	Read the results of the G.821 performance tests.
ERR_SECS ?	Errored secs.
n	
SES ?	Severely errored secs (BER worse than 1×10^{-3}.)
n	
DEG_MINS ?	Degraded mins (BER worse than 1×10^{-6}.)
n	
UNAVAIL ?	Unavailable secs.
n	
PER_EFS ?	Percentage error free secs.
p	
PER_ES ?	Percentage errored secs.
p	
PER_NON_SES ?	Percentage non severely errored secs.
p	
PER_SES ?	Percentage severely errored secs.
p	
PER_GOOD_MIN ?	Percentage good minutes - 100% good (percentage non-degraded minutes).
p	
PER_BAD_MIN ?	Percentage bad minutes - 0% good (percentage degraded minutes).
p	
PER_AVAIL ?	Percentage available secs.
p	
PER_UNAVAIL ?	Percentage unavailable secs.
p	
BREAKS ?	Total breaks.
n	
PERF_G821 ?	Read the results of the G.821 performance tests, including limit checks.
PER_ES ?	
P,n1,n2	
n1 = 0 *or* UNDER_LIMIT	1 *or* OVER_LIMIT
n2 = 0 *or* OFF	1 *or* ON
PER_SES ?	
P,n1,n2	
n1 = 0 *or* UNDER_LIMIT	1 *or* OVER_LIMIT
n2 = 0 *or* OFF	1 *or* ON
PER_BAD_MIN ?	
P,n1,n2	
n1 = 0 *or* UNDER_LIMIT	1 *or* OVER_LIMIT
n2 = 0 *or* OFF	1 *or* ON
PER_UNAVAIL ?	
P,n1,n2	
n1 = 0 *or* UNDER_LIMIT	1 *or* OVER_LIMIT
n2 = 0 *or* OFF	1 *or* ON

PERF_G826 ?	Read the results of the G.826 performance tests, including limit checks.
ES_RATIO	
r,n1,n2	
n1 = 0 *or* UNDER_LIMIT	1 *or* OVER_LIMIT
n2 = 0 *or* OFF	1 *or* ON
SES_RATIO ?	
r,n1,n2	
n1 = 0 *or* UNDER_LIMIT	1 *or* OVER_LIMIT
n2 = 0 *or* OFF	1 *or* ON
BBE_RATIO ?	
r,n1,n2	
n1 = 0 *or* UNDER_LIMIT	1 *or* OVER_LIMIT
n2 = 0 *or* OFF	1 *or* ON
PER_UNAVAIL ?	
P,n1,n2	
n1 = 0 *or* UNDER_LIMIT	1 *or* OVER_LIMIT
n2 = 0 *or* OFF	1 *or* ON
PERF_M2100 ?	Read the results of the M.2100 performance tests, including limit checks.
ERR_SECS ?	
n1,n2,n3,n4	
n1 = ES	
n2 = 0 *or* UNDER_LIMIT	1 *or* OVER_S1_LIM 2 *or* OVER_S2_LIM
n3 = 0 *or* OFF	1 *or* ON (S1)
n4 = 0 *or* OFF	1 *or* ON (S2)
SES ?	
n1,n2,n3,n4	
n1 = SES	
n2 = 0 *or* UNDER_LIMIT	1 *or* OVER_S1_LIM 2 *or* OVER_S2_LIM
n3 = 0 *or* OFF	1 *or* ON (S1)
n4 = 0 *or* OFF	1 *or* ON (S2)
UNAVAL ?	
n1,n2,n3,n4	
n1 = unavailable seconds	
n2 = 0 *or* UNDER_LIMIT	1 *or* OVER_S1_LIM 2 *or* OVER_S2_LIM
n3 = 0 *or* OFF	1 *or* ON (S1)
n4 = 0 *or* OFF	1 *or* ON (S2)
SLIPS ?	Read slips results.
POS_OCTET ?	Number of positive octet slips.
n	
NEG_OCTET ?	Number of negative octet slips.
n	
INTERVAL ?	Time between last slips.
n	Seconds.
SINCE ?	Time since last slip.
n	Seconds.
SYNC ?	Read the sync status results.
NO_SIGNAL ?	
n1,n2	
n1 = number of events	
n2 = number of secs	
AIS_RECEIVED ?	
n1,n2	
n1 = number of events	
n2 = number of secs	
NO_FRAME_SYN ?	
n1,n2	
n1 = number of events	
n2 = number of secs	

NO_PATT_SYNC ?
n1,n2
n1 = number of events
n2 = number of secs
NO_CRC_SYNC ?
n1,n2
n1 = number of events
n2 = number of secs

DEMUX_140M?	Demux measurements at 140Mbit/s.
PERFORMANCE?	140M demux frame bit G.821 results
ERR_SECS ?	Errored secs.
n	
SES ?	Severely errored secs (BER worse than 1×10^{-3}.)
n	
UNAVAIL ?	Unavailable secs.
n	
PER_EFS ?	Percentage error free secs.
p	
PER_ES ?	Percentage errored secs.
p	
PER_NON_SES ?	Percentage non severely errored secs.
p	
PER_SES ?	Percentage severely errored secs.
p	
PER_AVAIL ?	Percentage available secs.
p	
PER_UNAVAIL ?	Percentage unavailable secs.
p	
ERRORS?	140M demux framing error results
FRAME_BIT?	
n,r	
n = total frame bit errors	
r = frame bit error ratio	
FRAME_WORD?	
n,r	
n = total frame word errors	
r = frame word error ratio	
SYNC?	140M demux sync status results.
NO_SIGNAL?	
n1,n2	
n1 = number of events	
n2 = number of secs	
AIS_RECEIVED?	
n1,n2	
n1 = number of events	
n2 = number of secs	
NO_FRAME_SYN?	
n1,n2	
n1 = number of events	
n2 = number of secs	

DEMUX_34M?	Demux measurements at 34Mbit/s.
PERFORMANCE?	34M demux frame bit G.821 results
ERR_SECS ?	Errored secs.
n	
SES ?	Severely errored secs (BER worse than 1×10^{-3}.)
n	
UNAVAIL ?	Unavailable secs.
n	
PER_EFS ?	Percentage error free secs.
p	
PER_ES ?	Percentage errored secs.
p	
PER_NON_SES ?	Percentage non severely errored secs.
p	
PER_SES ?	Percentage severely errored secs.
p	
PER_AVAIL ?	Percentage available secs.
p	
PER_UNAVAIL ?	Percentage unavailable secs.
p	
ERRORS?	34M demux framing error results
FRAME_BIT?	
n,r	
n = total frame bit errors	
r = frame bit error ratio	
FRAME_WORD?	
n,r	
n = total frame word errors	
r = frame word error ratio	
SYNC?	34M demux sync status results.
NO_SIGNAL?	
n1,n2	
n1 = number of events	
n2 = number of secs	
AIS_RECEIVED?	
n1,n2	
n1 = number of events	
n2 = number of secs	
NO_FRAME_SYN?	
n1,n2	
n1 = number of events	
n2 = number of secs	

DEMUX_8M?	Demux measurements at 8Mbit/s.
PERFORMANCE?	8M demux frame bit G.821 results
ERR_SECS ?	Errored secs.
n	
SES ?	Severely errored secs (BER worse than
n	1×10^{-3}.)
UNAVAIL ?	Unavailable secs.
n	
PER_EFS ?	Percentage error free secs.
p	
PER_ES ?	Percentage errored secs.
p	
PER_NON_SES ?	Percentage non severely errored secs.
p	
PER_SES ?	Percentage severely errored secs.
p	
PER_AVAIL ?	Percentage available secs.
p	
PER_UNAVAIL ?	Percentage unavailable secs.
p	
ERRORS?	8M demux framing error results
FRAME_BIT?	
n,r	
n = total frame bit errors	
r = frame bit error ratio	
FRAME_WORD?	
n,r	
n = total frame word errors	
r = frame word error ratio	
SYNC?	8M demux sync status results.
NO_SIGNAL?	
n1,n2	
n1 = number of events	
n2 = number of secs	
AIS_RECEIVED?	
n1,n2	
n1 = number of events	
n2 = number of secs	
NO_FRAME_SYN?	
n1,n2	
n1 = number of events	
n2 = number of secs	

DEMUX_2M?	Demux measurements at 2Mbit/s.
PERFORMANCE?	2M demux frame bit G.821 results
ERR_SECS ?	Errored secs.
n	
SES ?	Severely errored secs (BER worse than 1×10^{-3}.)
n	
UNAVAIL ?	Unavailable secs.
n	
PER_EFS ?	Percentage error free secs.
p	
PER_ES ?	Percentage errored secs.
p	
PER_NON_SES ?	Percentage non severely errored secs.
p	
PER_SES ?	Percentage severely errored secs.
p	
PER_AVAIL ?	Percentage available secs.
p	
PER_UNAVAIL ?	Percentage unavailable secs.
p	
ERRORS?	2M demux framing error results
FRAME_BIT?	
n,r n = total frame bit errors r = frame bit error ratio	
FRAME_WORD?	
n,r n = total frame word errors r = frame word error ratio	
SYNC?	2M demux sync status results.
NO_SIGNAL?	
n1,n2 n1 = number of events n2 = number of secs	
AIS_RECEIVED?	
n1,n2 n1 = number of events n2 = number of secs	
NO_FRAME_SYN?	
n1,n2 n1 = number of events n2 = number of secs	
SDATA?	Structured Data measurements.
PATTERN_PER?	
ERR_SECS ?	Errored secs.
n	
SES ?	Severely errored secs (BER worse than 1×10^{-3}.)
n	
UNAVAIL ?	Unavailable secs.
n	
PER_EFS ?	Percentage error free secs.
p	
PER_ES ?	Percentage errored secs.
p	

PER_NON_SES ?	Percentage non severely errored secs.
p	
PER_SES ?	Percentage severely errored secs.
p	
PER_AVAIL ?	Percentage available secs.
p	
PER_UNAVAIL ?	Percentage unavailable secs.
p	
FRAMING_PER?	
ERR_SECS ?	Errored secs.
n	
SES ?	Severely errored secs (BER worse than 1×10^{-3}.)
n	
UNAVAIL ?	Unavailable secs.
n	
PER_EFS ?	Percentage error free secs.
p	
PER_ES ?	Percentage errored secs.
p	
PER_NON_SES ?	Percentage non severely errored secs.
p	
PER_SES ?	Percentage severely errored secs.
p	
PER_AVAIL ?	Percentage available secs.
p	
PER_UNAVAIL ?	Percentage unavailable secs.
p	
ERRORS?	SData error results
PATTERN?	
n,r, n1 n = total pattern errors r = pattern error ratio n1 = total pattern bits	
FRAMING?	
n,r, n1 n = total framing errors r = framing error ratio n1 = total framing bits	
SYNC?	SData sync status results.
SIGNAL?	
n1,n2 n1 = number of events n2 = number of secs	
FRAMING?	
n1,n2 n1 = number of events n2 = number of secs	
PATTERN?	
n1,n2 n1 = number of events n2 = number of secs	

RES_STATUS	**Read the results status.**
RES_STATUS ?	
0 *or* STOPPED	
1 *or* RUNNING	

RS232_PORT	**Set or Read the RS-232 port parameters.**
RS232_PORT ?	
INTERFACE (?)	
0 *or* NONE	
1 *or* REMOTE	
2 *or* PRINTER	
3 *or* SHARER	
4 *or* TERMINAL	
BIT_RATE (?)	
0 *or* BR_300	
1 *or* BR_600	
2 *or* BR_1200	
3 *or* BR_2400	
4 *or* BR_4800	
5 *or* BR_9600	
6 *or* BR_19200	
7 *or* BR_38400	
FORMAT (?)	
0 *or* F_7_O_1	7 data bits, odd parity, 1 stop bit.
1 *or* F_7_O_2	7 data bits, odd parity, 2 stop bit.
2 *or* F_7_E_1	7 data bits, even parity, 1 stop bit.
3 *or* F_7_E_2	7 data bits, even parity, 2 stop bit.
4 *or* F_8_N_1	8 data bits, no parity, 1 stop bit.
5 *or* F_8_N_2	8 data bits, no parity, 2 stop bit.
HANDSHAKE (?)	
0 *or* SOFTWARE	X-ON/X-OFF data flow control.
1 *or* HARD_SOFT (see Fig. 4-1)	Modem connection, RTS/CTS modem control, X-ON/X-OFF flow control.
2 *or* HARDWARE (see Fig. 4-3)	RTS/CTS/DSR/DTR flow control.

Note **After changing the RS232 parameters a delay of 1 Second is recommended.**

RX_DATA — **Set or Read Rx Data setup.**

RX_DATA ?
CONFIGURE ? — Set or Read Rx Data Interface Parameters.

SYSTEM (?)
- 0
- 1 *or* RS232_DTE
- 2 *or* RS232_DCE
- 3 *or* CODIR
- 4 *or* CONTRA
- 5 *or* RS449B_DTE
- 6 *or* RS449U_DTE
- 7 *or* RS449B_DCE
- 8 *or* RS449U_DCE
- 9 *or* X21B_DTE
- 10 *or* X21U_DTE
- 11 *or* X21B_DCE
- 12 *or* X21U_DCE
- 13 *or* V35_DTE
- 14 *or* V35_DCE
- 15 *or* EUROCOM
- 16 *or* TTL

MODE (?)
- 0 *or* SYNC
- 1 *or* ASYNC
- 2 *or* UNSTRUCTURED

INPUT_MODE (?)
- 0 *or* UNTERMINATED
- 1 *or* TERMINATED

LINE_CODE (?)
- 0 *or* NRZ
- 1 *or* CODIR
- 2 *or* AMI
- 3 *or* BI_MARK
- 4 *or* BI_SPACE

BIT_RATE (?)
- f — kbits/s

PATTERN (?)
- 0 *or* PRBS
- 1 *or* WORD
- 2 *or* FOX_A
- 3 *or* FOX_B
- 4 *or* FOX_C
- 5 *or* USER_MSG

PRBS_LEN (?)
- 0 *or* TWO_9
- 1 *or* TWO_11
- 2 *or* TWO_15
- 3
- 4 or TWO_20

PRBS_SENSE (?)	
0 *or* TRUE	
1 *or* INVERT	
CLOCK_SOURCE (?)	
0 *or* DCE	Clock from DCE.
1 *or* DTE	Clock from DTE.
2 *or* TRANSMITTER	Uses Tx internal clock.
3 *or* EXTERNAL	
4 *or* RECEIVER	Clock signal extracted from data.
5 *or* CONTRA	Contra clock.
6 *or* EXT_TTL	
7 *or* EUROCOM	
CLOCK_SENSE (?)	
0 *or* TRUE	
1 *or* INVERT	
ASYNC ?	Set or Read Rx Async Parameters.
BIT_RATE (?)	
0 *or* BR_50	
1 *or* BR_75	
2 *or* BR_100	
3 *or* BR_110	
4 *or* BR_134	
5 *or* BR_200	
6 *or* BR_300	
7 *or* BR_600	
8 *or* BR_1200	
9 *or* BR_1800	
10 *or* BR_2000	
11 *or* BR_2400	
12 *or* BR_3600	
13 *or* BR_4800	
14 *or* BR_9600	
15 *or* BR_19200	
16 *or* BR_38400	
DATA_BITS (?)	
0 *or* B_5	
1 *or* B_6	
2 *or* B_7	
3 *or* B_8	
PARITY (?)	
0 *or* NONE	
1 *or* ODD	
2 *or* EVEN	
STOP_BITS (?)	
0 *or* B_1	
1 *or* B_1_5	1½ stop bits
2 *or* B_2	
USER_MSG (?)	
n1,n2,n3,....,n?	A list of between 1 and 19 characters.
NPD ?	Network Propagation Delay parameters.
MODE (?)	
0 *or* STOP	
1 *or* EXECUTE	
TIME ?	
f	mSecs
BITS ?	
n	

RX_INFO — Reads the Rx Status Information

RX_INFO?	
DATA?	
CHAR_RATE?	Reads the Rx async character rate.
n	
FREQ?	Read Rx frequency.
f	Hz
OFFSET?	Read Rx offset.
n	ppm
STATE?	Read Rx status.
n1,n2	
n1 = 0 or CLOCK_OK	
1 or NO_CLOCK	
n2 = 0 or NO_ALARMS	
1 or ALARMS	
WORD?	Read the Received word.
b	
CTRL_LINES ?	Read Control Lines.

b

			RS232		V35		RS449		X21	
			DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
Bit	0	=	DTR	DSR	.	.	.	.	.	.
	1	=	RL	TM	.	.	.	.	.	.
	2	=	RTS	CTS	RTS	CTS	RS	CS	C	I
	3	=	.	.	.	.	.	.	.	.
	4	=	LL	RLSD	.	.	.	.	.	.
	5	=	.	.	.	.	.	.	.	.
	6	=	.	.	.	.	.	.	.	.
	7	=	.	.	.	.	.	.	.	.

CTRL_DELAY ?	Read RTS-CTS delay.
n	mSecs.
DEMUX?	
FREQ_140M?	140M Demux frequency.
f	Hz
OFFSET_140M?	140M Demux offset
n	ppm
FREQ_34M?	34M Demux frequency.
f	Hz
OFFSET_34M?	34M Demux offset
n	ppm
JUST_34M?	34M Demux justification ratio
f	
FREQ_8M?	8M Demux frequency.
f	Hz
OFFSET_8M?	8M Demux offset
n	ppm
JUST_8M?	8M Demux justification ratio
f	
FREQ_2M?	2M Demux frequency.
f	Hz
OFFSET_2M?	2M Demux offset
n	ppm
JUST_2M?	2M Demux justification ratio
f	
OVERHEAD?	Demux overhead bits.
b	

bit 0 = 8M N bit
1 = 34M N bit
2 = 140M 1st N bit
3 = 140M 2nd N bit
4 = 140M 3rd N bit

PCM?
FREQ? — Read Rx frequency.
f — Hz
OFFSET? — Read Rx offset.
n — ppm
OVERHEAD? — Read the received overhead bits.
b1,b2,b3

```
                                      b1 Bits            b2 Bits       b3 Bits
                                  FEDCBA9876543210   FEDCBA9876543210  76543210

RX_PCM:CONFIGURE:SYSTEM =  S704K     .....TKKIINUUUUU   ................  ........
                           T1SF      ................   ................  ........
                           T1SFNS    ................   ................  ........
                           T1DM      ..............A.   ................  ........
                           T1ESF     ................   ................  ........
                           T1ESFNS   ................   ................  ........
                           T1SLC96   .......CCCAALLLL   ................  ........
                           S2M       .....PPPIINUUUUU   ................  ........
                           S2MNOMF   ........IINUUUUU   ................  ........
                           S2MCRC    .......PPPNUUUUU   ................  ...II...
                           S2MCNOMF  ..........NUUUUU   ................  ...II...
                           S2M32FR   .....PPPIINUUUUU   ................  ........
                           T1CM1     ................   ................  ........
                           T1CM2     ................   ................  ........
                           T2ASYNC   ................   ................  ........
                           T2SYNC    ............XXX.   ................  ........
                           S6MIW     ...............A   ................  ........
                           S8M742    ...............N   ................  ........
                           S8M745    .........SSSSUUU   ................  ........
                           S8M744    ...............S   ................  ........
                           S8M741    ...............S   KKKKKKKKKKKKKKKK  ........
```

STATE? — Read Rx status
n1,n2
n1 = 0 or CLOCK_OK
1 or NO_CLOCK
n2 = 0 or NO_ALARMS
1 or ALARMS
TONE_LEVEL ? — Read Rx audio level
f — dBmO
WORD? — Read the Received word
b

SDATA?
STATUS_BIT? — Status bit
1 bit
STATUS_WORD? — Framed status word
7 bits
H_KEEP_AH? — X.50 80 channel
7 bits — Housekeeping bits B to H
MEAS_BRATE? — Received frequency
nn.nnn — kbit/s
USER_RATE? — User data rate
nn.n — kbit/s
CLOCK_SIGNAL? — Timing signal
0 or ABSENT
1 or PRESENT
DATA_SIGNAL? — Data signal
0 or Absent
1 or Present
FRAME_SYNC? — Frame synchronisation
0 or ABSENT
1 or ACHIEVED
STATUS_SYNC? — Framed Status Synchronisation
0 or LOST
1 or ACHIEVED
2 or LOST
3 or OBSERVATION

4 or LOOPBACK_2
5 or LOOPBACK_3
6 or NORMAL
7 or EQUIP_FAULT
8 or LOOPBACK
9 or LINE_FAULT

LEARNT?	Learnt parameters
DATA_RATE?	Reiterated data rate
0 or LEARN not learnt	
1 or DR_600	
2 or DR_1200	
3 or DR_2400	
4 or DR_4800	
5 or DR_9600	
6 or DR_14400	
7 or DR_19200	
8 or DR_48000	
TEST_PATTERN?	
0 or LEARN not learnt	
1 or ONES	
2 or ZEROS	
3 or ALTERNATE	
4 or PRBS_N	
5 or WORD_12BIT	
6 or WORD_16BIT	
7 or WORD_NBIT	
PRBS_LEN?	PRBS length
n	
PRBS_SENSE?	
0 or TRUE	
1 or INVERT	
WORD?	
n bits	
WORD_LEN?	Word length
n	

RX_MODE **Set or Read Rx mode of operation**

RX_MODE(?)
0 or PCM
1 or DATA
2 or SDATA
3 or PCM_SDATA

RX_PCM **Set or Read Rx PCM setup.**

RX_PCM(?)
CONFIGURE(?) Set or Read Rx PCM Interface Parameters.

SYSTEM(?)
0
1 *or* S704K
2 *or* T1SF
3 *or* T1SFNS
4 *or* T1DM
5 *or* T1ESF
6 *or* T1ESFNS
7 *or* T1SLC96
8
9 or S256K
10 or S512K
11 or S1024K
12 *or* S2M
13 *or* S2MNOMF
14 *or* S2MCRC
15 *or* S2MCNOMF
16 *or* S2M32FR
17
18
19 *or* T1CM1
20 *or* T1CM2
21 *or* T2ASYNC
22 *or* T2SYNC
23 *or* S6MIW
24
25 *or* S8M742
26 *or* S8M745
27 *or* S8M744
28 *or* S8M741
29 *or* S34MUF
30 or S140MUF
31 *or* NON_STD
BANK(?)
0 *or* D1D
1 *or* D2
2 *or* D3D4
ALBO(?)
0 *or* OUT
1 *or* IN
MODE(?)
0 *or* UNFRAMED
1 *or* FRAMED
2 *or* CHANNEL
3 *or* NX64
4 *or* TRIB1
5 *or* TRIB2
6 *or* TRIB3
7 *or* TRIB4

INPUT_MODE(?)
- 0 *or* TERMINATED
- 1 *or* BRIDGING
- 2 *or* MONITOR
- 3 *or* MONITOR_14DB
- 4 or MONITOR_15DB
- 5 *or* MONITOR_20DB
- 6 *or* MONITOR_26DB
- 7 *or* MONITOR_30DB
- 8 *or* MONITOR_38DB
- 9 *or* NRZ
- 10 *or* V35
- 11 *or* X21
- 12 *or* RS449

CLOCK_SOURCE(?)
- 0 *or* EXT_TTL
- 1 *or* EXT_34M
- 2 or EXT_140M

CLOCK_INPUT(?)
- 0 *or* TRUE
- 1 *or* INVERT

BIT_RATE(?)
- f kbits/s

PATTERN(?)
- 0 *or* QRSS
- 1 *or* PRBS
- 2 *or* WORD
- 3 *or* WORD_8BIT
- 4 *or* WORD_16BIT
- 5 *or* WORD_24BIT
- 6 *or* VOICE
- 7 *or* DATA
- 8 *or* STRUCT_DAT
- 9 or LIVE

PRBS_LEN(?)
- 0 *or* TWO_9 (PRBS Length 2^9-1).
- 1 *or* TWO_11
- 2 *or* TWO_15
- 3 *or* TWO_18
- 4 *or* TWO_20
- 5 *or* TWO_23
- 6 *or* TWO_25
- 7 *or* TWO_28
- 8 or TWO_31

PRBS_SENSE(?)
- 0 *or* TRUE
- 1 *or* INVERT

PRBS_LIMIT(?)
- 0 *or* NONE
- 1 *or* SEVEN
- 2 *or* FOURTEEN

PRBS_OCTET(?)
- 0 *or* MODE_7P1 (7 prbs + 1 fixed bit).
- 1 *or* ALL_8

DATA_CODE(?)	
0 *or* CODIR	
1 *or* CONTRA	
2 *or* DS0	
3 *or* NRZ	
4 *or* X21	
5 *or* V35	
6 *or* RS449	
DATA_TIMED(?)	
0 *or* FROM_RX	
1 *or* FROM_TX	
CHANNEL(?)	Channel number.
n	Limits depend on SYSTEM.
NX64(?)	
b	b=32 bits (LSB = channel 1) 1 bit per channel.
LINE_CODE(?)	
0 *or* AMI	
1 *or* HDB3	
2 *or* B8ZS	
3 *or* B6ZS	
4 or CMI	
5 or TTL	
6 or ECL	
SPEAKER(?)	
0 *or* OFF	
1 *or* ON	
LINE?	
FREQ?	Received frequency.
f	Hz.
OFFSET?	Offset from selected bit rate.
n	ppm.
IMPEDANCE(?)	
0 *or* BALANCED	
1 *or* UNBALANCED	
LEVEL?	Line level.
f	Volts.
DB?	Line level relative to nominal input.
f	dB.
VREF?	Nominal input level.
f	Volts
SIGNAL?	Read or Set Signalling parameters.
MODE(?)	
0 *or* SINGLE	
1 *or* ALL_CHANNEL	
2 *or* DTMF	
3 *or* C_BIT	
CHANNEL(?)	Single channel number.
n	
PRESENT?	Returns present signalling code.
n	
PREVIOUS?	Returns previous signalling code.
n	
DTMF_CHANNEL(?)	Set or Read DTMF channel number.
n	
DIALLED_NO?	Returns last dialled number
s	
where s="12X4" indicates 1, 2, Errored number and 4 were dialled.	
ERRORS?	Returns dialling error code.
s	

		where s="??n?" indicates error code n in the X position above.	
		and n = 1 = Wrong Code.	
		2 = Short Pulse Break.	
		3 = Long Pulse Break.	
		4 = Short Inter-Pulse Break.	
		5 = Short Inter-Digit Pause.	
		6 = Excess Digits.	
	IDLE_CODE(?)		
		b	2 or 4 bit word depending on system.
	ALL_CHANNELS?		
		n1,n2,n3,....n?	(n24 or n30 depending on system).
	C_BITS?		Read C-bit framing.
		b	
NPD?			Set or Read Network Propagation Delay parameters.
	MODE(?)		
		0 *or* STOP	
		1 *or* EXECUTE	Only if test not running.
	TIME?		Time delay.
		f	mSecs.
	BITS?		Bits delay.
		n	
DEMUX?			Read or set the DEMUX parameters
	MODE(?)		
		0 *or* ON	
		1 *or* OFF	
	FROM(?)		Demux from line system.
		0 *or* S8M	
		1 *or* S34M	
		2 or S140M	
	TO(?)		Demux to base system.
		0 *or* S2M	
		1 *or* S8M	
		2 or S34M	
	INPUT_MODE(?)		
		0 *or* TERMINATED	
		1 *or* BRIDGING	
		2 *or* MONITOR_14DB	
		3 *or* MONITOR_26DB	
		4 *or* MONITOR_38DB	
	LINE_CODE(?)		
		0 *or* AMI	
		1 *or* HDB3	
		2	
		3	
		4 or CMI	
		5 or TTL	
		6 or ECL	
	CLOCK_INPUT(?)		
		0 or TRUE	
		1 or INVERT	
	TRIB_34M(?)		
		n	
	TRIB_8M(?)		
		n	
	TRIB_2M(?)		
		n	

RX_SDATA

Set or Read Rx Structured Data setup.

RX_SDATA(?)

INTERFACE(?)

Set or Read Rx SData Interface Parameters.

0 *or* BIN_TTL
1 *or* BAL_V11
2 *or* BAL_120
3 *or* PCM_CHANNEL

TERMINATION(?)

0 *or* TERMINATED
1 *or* UNTERMINATED

LINE_CODE(?)

0 *or* NRZ
1 *or* CODIR
2 *or* CONTRA
3 *or* AMI_50
4 or AMI_100
5 or BIP_MARK
6 or BIP_SPACE

STRUCTURE(?)

0
1 *or* X50_80CH
2 *or* X50_20CH
3 *or* UNSTRUCTURED
4 or STRUCT_8BIT
5 or STRUCT_7BIT
6 or S6_PLUS_2

BIT_RATE(?)

nnn.nnn

TIMING_SRC(?)

0 *or* BIN_TTL
1 *or* BAL_V11
2 *or* BAL_120
3 *or* CONTRA
4 or RX_SIGNAL
5 or INTERNAL

TIM_SRC_POL(?)

0 *or* TRUE
1 *or* INVERT

ALIGN_LOCK(?)

0 *or* OFF
1 *or* ON

TIMING-OUT(?)

0 or NONE
1 *or* BIN_TTL
2 *or* BAL_V11
3 *or* BAL_120
4 *or* CONTRA

TIM_OUT_POL(?)

0 *or* TRUE
1 *or* INVERT

DATA_RATE(?)

0 or LEARN
1 or DR_600
2 or DR_1200
3 or DR_2400

	4 or DR_4800	
	5 or DR_9600	
	6 or DR_14400	
	7 or DR_19200	
	8 or DR_48000	
	9 or USER	
X50_CHANNEL(?)		
	n	Channel number
X50_CH_PAIR(?)		
	0 or CHAN_1_2	
	1 or CHAN_1_3	
	2 or CHAN_1_4	
	3 or CHAN_1_5	
	4 or CHAN_2_3	
	5 or CHAN_2_4	
	6 or CHAN_2_5	
	7 or CHAN_3_4	
	8 or CHAN_3_5	
	9 or CHAN_4_5	
	10 or CHAN_5_4	
X50_CH_MASK(?)		
	80 bits	
TEST_PATTERN(?)		
	0 or LEARN	
	1 or ONES	
	2 or ZEROS	
	3 or ALTERNATE	
	4 or PRBS_N	
	5 or WORD_12BIT	
	6 or WORD_16BIT	
	7 or WORD_NBIT	
	8 or TRAFFIC	
PRBS_LEN(?)		
	n	Length
PRBS_SENSE(?)		
	0 OR TRUE	
	1 OR INVERT	
WORD(?)		
	n bits	Word value
WORD_LEN(?)		
	n	Length
STATUS_MODE(?)		
	0 or UNFRAMED	
	1 or FRAMED	
	2 or COMMAND	
	3 or RESPONSE	
IN_THRESH(?)		
	n.nn	Level
OUT_THRESH(?)		
	n.nn	Level
PATTERN_MASK(?)		Set or read the pattern mask bits.
	8 bits	

SDME_MASK **Set or Read Structured Data Measurement Summary mask.**

SDME_MASK(?)
b
Bit 0 = Frame error.
1 = Pattern error.
2 = 15 Unassigned.

Set a bit to zero to inhibit reading the equivalent bit in the summary register. (See Fig. 4-9).

SDME-MSUMM **Read Structured Data Measurement Summary register ANDED with SDME_MASK.**

SDME_MSUMM?
b
Read only those bits allowed by SDME_MASK.
All bits are cleared when the summary is read.

SDME_SUMMARY **Read Structured Data Measurement Summary mask.**

SDME_SUMMARY?
b
A bit is set for any of the occurrences.
All bits are cleared when the summary is read. (See Fig. 4-9).
Note... The SDME summary bit in the SD register will be set (only if SDME_MASK is enable) if events listed in SDME_MASK occur.

SDRX_MASK **Set or Read Structured Data Receiver Summary mask.**

SDRX_MASK(?)
b
Bit 0 = Data signal state change.
1 = Clock signal state change.
2 = Alarm change.
3 = House keeping changed.
4 = Status bit changed.
5 = Framed status byte changed.
6 = BT loopback made.
7 = SIP loopback made.
8 = SIP loopback dropped.
9 = DER change.

Set a bit to zero to inhibit reading the equivalent bit in the summary register. (See Fig. 4-10).

SDRX-MSUMM **Read Structured Data Receiver Summary register ANDED with SDRX_MASK.**

SDRX_MSUMM?
b
Read only those bits allowed by SDRX_MASK.
All bits are cleared when the summary is read.

SDRX_SUMMARY **Read Structured Data Receiver Summary mask.**

SDRX_SUMMARY?
b
A bit is set for any of the occurrences.
All bits are cleared when the summary is read. (See Fig. 4-10).
Note... The SDRX summary bit in the SD register will be set (only if SDRX_MASK is enable) if events listed in SDRX_MASK occur.

SDTX_MASK **Set or Read Structured Data Transmitter Summary mask.**

SDTX_MASK(?)
b
Bit 0 = Drop and insert signal state change.
1 = Clock signal state change.
2 = Framing sync state change.
3 = 15 Unassigned.

Set a bit to zero to inhibit reading the equivalent bit in the summary register. (See Fig. 4-11).

SDTX-MSUMM **Read Structured Data Transmitter Summary register ANDED with SDTX_MASK.**

SDTX_MSUMM?
b
Read only those bits allowed by SDTX_MASK.
All bits are cleared when the summary is read.

SDTX_SUMMARY **Read Structured Data Transmitter Summary mask.**

SDTX_SUMMARY?
b
A bit is set for any of the occurrences.
All bits are cleared when the summary is read. (See Fig. 4-11).
Note... The SDTX summary bit in the SD register will be set (only if SDTX_MASK is enable) if events listed in SDTX_MASK occur.

SD_MASK **Set or Read Structured Data Summary mask.**

SD_MASK(?)

b

Bit 0 = Structured Data Tx summary bit (SDTX-S)
1 = Structured Data Rx summary bit (SDRX-S)
2 = Structured Data ME summary bit (SDME-S)
3 = 15 Unassigned

Set a bit to zero to inhibit reading the equivalent bit in the summary register. (See Fig. 4-12).

SD-MSUMM **Read Structured Data Summary register ANDED with SD_MASK.**

SD_MSUMM?

b

Read only those bits allowed by SD_MASK.
Bits are cleared when the summary bits (SDXX_S) are cleared.

SD_SUMMARY **Read Structured Data Summary mask.**

SD_SUMMARY?

b

A bit is set for any of the occurrences.
All bits are cleared when the summary is read. (See Fig. 4-12).
Note... The SD summary bit in status byte register (*STB) will be set (only if SD_MASK is enable) if events listed in SD_MASK occur.

SHIFT_PRINT	**Print G821 store.**
SHIFT_PRINT	

Note **This command is only valid if a G821 histogram page is currently displayed.**

SIG_DIGITS		**Set or Read the number of digits after decimal point.**
SIG_DIGITS(?)		
	n	1 to 12 significant digits. (see also OUT_FORMAT).
SOFT_VERSION?		
	S1, S2, S3	
START		**Start a test.**
START		Only if test not running.
STOP		**Stop a test.**
STOP		
STORE		**Read/Write from/to stores.**
STORE?		
DELETE	n	Delete store.
	n = 0-17	Stores 18 - 35 cannot be deleted.
RECALL	n	Recall store.
	n = 0-35	
STORE	n,s	Store configuration.
	n = 0-17	
	s = String up to 12 ASCII characters in either single or double quotes. (Stores 18 - 35) cannot be stored into.	
NAME?		n
	n = 0-34	returns s = name of store.
STATUS?		n
	n = 0-34	Returns n = store status where n = 0 *or* EMPTY 1 *or* VALID 2 *or* CORRUPTED 3 *or* INVALID
FIXED_RECALL?		n
	n = 0-49	Recalls fixed store (see below).
FIXED_NAME?		n
	n = 0-49	Returns fixed store name (see below).

No. Name	No. Name
0 DEFAULT	
1 MULDEX_140M	27 T1NOSIG_NX64
2 MULDEX_34M	28 T1ESFNOSIGNX
3 MULDEX_8M	29 T1NOSIG_64K
4 UNFRAMD_140M	30 T1ESFNOSIG64
5 UNFRAMED_34M	31 T1SIG_VF
6 UNFRAMED_8M	32 T1ESF_SIG_VF
7 T2_UNFRAMED	33 T1DM_64K
8 T2ASYNC_FRMD	34 S704K_UNFRAM
9 T2SYNC_FRAMD	35 S704K_64K_CH
10 T1C_UNFRAMED	36 S704K_NX64
11 T1CM2_FRAMED	37 EURO_IB5_256
12 T1CM1_FRAMED	38 X21_V11_DTE

13 S2M_UNFRAMED
14 S2M30_64K_CH
15 S2M31_64K_CH
16 S2M30CRC_64K
17 S2M31CRC_64K
18 S2M30_VF
19 S2M31_NX64
20 S2M30CRC_VF
21 S2M31C_NX64
22 S2M31_DTMF
23 S2M31C_DTMF
24 S2M30_DTMF
25 2M30C_DTMF
26 T1_UNFRAMED

39 RS449-V11DTE
40 V35_DTE
41 RS232_DTE
42 CODIRECTIONL
43 CONTRADIRNL
44 EURO_IB6_256
45 SPARE
46 X50_CODIR
47 X50_V11
48 X50_2M31
49 X50_2M31CRC

Examples

To store the current setup into store number 1
STORE:STORE 1, "TEST STORE"

The store can be recalled by
STORE:RECALL 1

The store status can be read by
STORE:STATUS? 1

this will return
1

if the store is valid

SWITCH **Set or Read the Switch box**

SWITCH?
TYPE(?)
0 *or* NOT_FITTED
1 *or* TYPE_1
DATA_PORT(?)
0 *or* X21B_DTE
1 *or* V35_DTE
2 *or* RS449_DTE
3 or NONE
PCM_PORT(?)
0 *or* UNBALANCED
1 *or* BALANCED

TEST	**Set or Read Test parameters.**
TEST?	
LIMITS?	Set or Read the G.821 Test Limits.
TYPE(?)	
0 *or* G821_LINE	
1 *or* G921_LINE	
2 *or* USER1	
3 *or* USER2	
LOCAL(?)	
n (0 to 5000)	G.821 line length (km).
MEDIUM(?)	
n (0 to 5000)	G.821 line length (km).
HIGH(?)	
n (0 to 50000)	G.821 line length (km).
MEDIUM_RADIO(?)	
n (0 to 5000)	G.821 line length (km).
HIGH_RADIO(?)	
n (0 to 50000)	G.821 line length (km).
CLASS1(?)	
n (0 to 5000)	G.921 line length (km).
CLASS2(?)	
n (0 to 5000)	G.921 line length (km).
CLASS3(?)	
n (0 to 2500)	G.921 line length (km).
CLASS4(?)	
n (0 to 2500)	G.921 line length (km).
CLASS1_RADIO(?)	
n (0 to 50000)	G.921 line length (km).
CLASS2_RADIO(?)	
n (0 to 5000)	G.921 line length (km).
CLASS3_RADIO(?)	
n (0 to 2500)	G.921 line length (km).
CLASS4_RADIO(?)	
n (0 to 2500)	G.921 line length (km).
DM_INTERVAL(?)	
f (0 to 9999.999)	USER1 threshold (errors)
ES_INTERVAL(?)	
f (0 to 65000.000)	USER1 threshold (errors)
SES_INTERVAL(?)	
f (0 to 65000.000)	USER1 threshold (errors)
DM_OBJ(?)	
f (0 to 100.000)	USER2 Objective (%)
ES_OBJ(?)	
f (0 to 100.000)	USER2 Objective (%)
SES_OBJ(?)	
f (0 to 100.000)	USER2 Objective (%)
DM_ALL(?)	
f (0 to 100.000)	USER2 Allocation (%)
ES_ALL(?)	
f (0 to 100.000)	USER2 Allocation (%)
SES_ALL(?)	
f (0 to 100.000)	USER2 Allocation (%)

LIMITS_G821(?)
    PER_ES(?)
        P (0 to 99.9999)
    PER_ES_EN(?)
        0 *or* OFF
        1 *or* ON
    PER_SES(?)
        P (0 to 99.9999)
    PER_SES_EN(?)
        0 *or* OFF
        1 *or* ON
    PER_DM(?)
        P (0 to 99.9999)
    PER_DM_EN(?)
        0 *or* OFF
        1 *or* ON
    PER_US(?)
        P (0 to 99.9999)
    PER_US_EN(?)
        0 *or* OFF
        1 *or* ON
LIMITS_G826(?)
    ES_RATIO(?)
        r (9.9E-2 to 1.0E-9)
    ES_RATIO _EN(?)
        0 *or* OFF
        1 *or* ON
    SES_RATIO(?)
        r (9.9E-2 to 1.0E-9)
    SES_RATIO _EN(?)
        0 *or* OFF
        1 *or* ON
    BBE_RATIO(?)
        r (9.9E-2 to 1.0E-9)
    BBE_RATIO _EN(?)
        0 *or* OFF
        1 *or* ON
    PER_US(?)
        P (0 to 99.9999)
    PER_US_EN(?)
        0 *or* OFF
        1 *or* ON
    FWD_PATH(?)
        0 *or* OFF
        1 *or* ON

LIMITS_M2100(?)
- ES_S1 (?)
  - n (0 to 9998)
- ES_S1_EN(?)
  - 0 *or* OFF
  - 1 *or* ON
- ES_S2(?)
  - n (0 to 9999)
- ES_S2_EN(?)
  - 0 *or* OFF
  - 1 *or* ON
- SES_S1 (?)
  - n (0 to 9998)
- SES_S1_EN(?)
  - 0 *or* OFF
  - 1 *or* ON
- SES_S2(?)
  - n (0 to 9999)
- SES_S2_EN(?)
  - 0 *or* OFF
  - 1 or ON
- US_S1 (?)
  - n (0 to 9998)
- US_S1_EN(?)
  - 0 *or* OFF
  - 1 *or* ON
- US_S2(?)
  - n (0 to 9999)
- US_S2_EN(?)
  - 0 *or* OFF
  - 1 or ON
- FWD_PATH (?)
  - 0 *or* OFF
  - 1 *or* ON

THRESHOLD(?)
- FR_ERRS(?)
  - n (0 to 9999)
- CRC_BLOCKS (?)
  - n (0 to 9999)
- REI(?)
  - n (0 to 9999)

PARAMETERS? — Set or Read the Test Parameters.

- LENGTH(?)
  - 0 *or* TIMED
  - 1 *or* INDEF
- TERM_AFTER(?)
  - hh,mm,ss
  - hh = hours (00-99).
  - mm = minutes (00-59).
  - ss = seconds (00-59).
- BUZZER(?)
  - 0 *or* DISABLE
  - 1 *or* ALARMS
  - 2 *or* ERRORS
  - 3 *or* BOTH
- GATING(?)
  - 0 *or* AUTO
  - 1 *or* G1_SEC
  - 2 *or* G2_SEC
  - 3 *or* G5_SEC
  - 4 *or* G10_SEC
- ERROR_TYPE(?)
  - 0 *or* LINE_CODE
  - 1 *or* PATTERN
  - 2 *or* FRAME_WORD
  - 3 *or* FRAME_BIT
  - 4 *or* FRAME_2M_W
  - 5 *or* FRAME_2M_B
  - 6 *or* FRAME_8M_W
  - 7 *or* FRAME_8M_B
  - 8 *or* FRAME_34M_W
  - 9 *or* FRAME_34M_B
  - 10 *or* FRAME_140M_W
  - 11 or FRAME_140M_B
  - 12 or CRC_BLOCK
  - 13 or S_PATTERN
  - 14 or S_FRAMING
- BURST_THRESH(?)
  - 0 *or* B8_ERRORS
  - 1 *or* B16_ERRORS
  - 2 *or* B32_ERRORS
  - 3 *or* B64_ERRORS
  - 4 *or* B128_ERRORS
  - 5 *or* B256_ERRORS

PROGRESS?	Read the Test Progress Time/Date.
START_TIME?	
yy,mm,dd,hh,mm,ss.	
yy = year	
mm = month	
dd = day	
hh = hour	
mm = minute	
ss = second	
TERM_AFTER?	Terminate after.
hh,mm,ss	
STOP_TIME?	
yy,mm,dd,hh,mm,ss	
MEAS_TIME?	Measurement time.
dd,hh,mm,ss	
POW_LOS_TIME?	Power loss time.
yy,mm,dd,hh,mm,ss	
SETUP?	Set or Read the G.821 test setup.
INTERVAL(?)	
0 *or* MIN_15	
1 *or* MIN_30	
2 *or* HR_1	
3 *or* HR_24	
STORED_INT(?)	
n (1 - 100)	
SD_LOOPBACK?	Set or Read Structured Data loopbacksetup
CONFIGURE?	
LOOP_MODE(?)	
0 *or* NONE	
1 *or* BT	
2 *or* SIP	
3 *or* DER	
4 or DER_SIP	
DER_TRIB(?)	(DER or DER_SIP mode.)
ASCII string “0-9,A,C”	Up to 20 characters. 1-9 =Channel number 0 =Channel 10 A =Prolonging Channel C =Common Channel
NUM_OF_WORDS(?)	(SIP or DER_SIP mode.)
n = 1 to 255	
LOOP_WORD(?)	(SIP or DER_SIP mode.)
6 bits for 6 bit structures or 8 bits for Unstructured	
CONTROL(?)	Set or Read Structured Data loop control parameters.
0 *or* DEACT_LOOP	
1 *or* ACT_LOOP	
2 *or* SEND_DER	
3 *or* REPEAT_DER	

LOOP_INFO?	
STATUS?	Read Structured Data loop status
0 *or* INACTIVE	
1 *or* ACTIVATING	
2 *or* DER-ROUTING	
3 *or* DER-ROUTING	
4 *or* DER_ACTIVE	
5 *or* LOOP_ACTIVE	
6 *or* DER_LOOP_ACT	
TRIB_INDEX?	Report current tributary index
n	
n = 0	0 = inactive
n <> 0	<> = position of tributary in sequence
ID_NUMBER? d	Report tributary identity number
n	
	d = 1 to 20
	n = identity of routed DER

THRESHOLD — **Set or Read the threshold.**

THRESHOLD(?)
r (9E-2 to 1E-9)

This will set the bit in the ME_SUMMARY register when the current error ratio crosses the value.

TIME — **Set or Read the Time.**

TIME(?)
hh,mm,ss
hh = hour (00-23).
mm = minute (00-59).
ss = second (00-59).

TXRX_MASK **Set or Read Transmitter/Receiver Summary mask.**

TXRX_MASK(?)
b
Bit 0 = Tx clock signal state change.
1 = Unassigned.
2 = Rx clock signal state change.
3 = Rx alarm change.
4 = Rx signalling/dialling change.
5 = Rx new dialled number.
6 = Rx ISDN state change.
7 = Unassigned
8 = Tx/Rx NPD new result.
9 = Tx/Rx RTS-CTS.
10 - 11 = Unassigned.
12 = 2M Demux alarm change.
13 = 8M Demux alarm change.
14 = 34M Demux alarm change.
15 = 140M Demux alarm change.

Set a bit to zero to inhibit reading the equivalent bit in the summary register. (See Fig. 4-7).

TXRX_MSUMM **Read Transmitter/Receiver Summary register ANDED with TXRX_MASK.**

TXRX_MSUMM?
b
Read only those bits allowed by TXRX_MASK.
All bits are cleared when the summary is read.

TXRX_SUMMARY **Read Transmitter/Receiver Summary register.**

TXRX_SUMMARY?
b
A bit is set for any of the occurrences.
All bits are cleared when the summary is read. (See Fig. 4-7).
Note... The TXRX summary bit in status byte register (*STB) will be set (only if TXRX_MASK is enabled) if events listed in TXRX-MASK occur.

TX_DATA	**Set or Read Tx Data setup.**
TX_DATA?	
CONFIGURE?	Set or Read Tx Data Interface Parameters.
SYSTEM(?)	
0	
1 *or* RS232_DTE	
2 *or* RS232_DCE	
3 *or* CODIR	
4 *or* CONTRA	
5 *or* RS449B_DTE	Balanced V.11
6 *or* RS449U_DTE	Unbalanced V.10
7 *or* RS449B_DCE	Balanced V.11
8 *or* RS449U_DCE	Unbalanced V.10
9 *or* X21B_DTE	Balanced V.11
10 *or* X21U_DTE	Unbalanced V.10
11 *or* X21B_DCE	Balanced V.11
12 *or* X21U_DCE	Unbalanced V.10
13 *or* V35_DTE	
14 *or* V35_DCE	
15 *or* EUROCOM	
16 *or* TTL	
MODE(?)	
0 *or* SYNC	
1 *or* ASYNC	
2 *or* UNSTRUCTURED	
LINE CODE(?)	
0 *or* NRZ	
1 *or* CODIR	
2 *or* AMI	
3 *or* BI_MARK	
4 *or* BI_SPACE	
BIT_RATE(?)	
f	kbits/s
PATTERN(?)	
0 *or* PRBS	
1 *or* WORD	
2 *or* FOX_A	
3 *or* FOX_B	
4 *or* FOX_C	
5 *or* USER_MSG	
6 *or* ONES	
7 *or* ZEROS	
8 *or* ALTERNATE	
9 *or* TWOWORDS	
PRBS_LEN(?)	
0 *or* TWO_9	
1 *or* TWO_11	
2 *or* TWO_15	
3	
4 *or* TWO_20	

PRBS_SENSE (?)
0 *or* TRUE
1 *or* INVERT
WORD (?)
b
b = programmable word
CLOCK_SOURCE (?)
0 *or* INTERNAL
1 *or* DCE
2 *or* X21_DCE
3 *or* EXTERNAL
4 *or* RECEIVER
5 *or* EXT_X32
6 *or* CONTRA
7 *or* EXT_TTL
8 *or* EUROCOM
CLOCK_SENSE
0 *or* TRUE
1 *or* INVERT
TIMING_OUT
0 *or* TRUE
1 *or* INVERT

ASYNC ? — Set or Read Tx Async Parameters.

BIT_RATE (?)
0 *or* BR_50
1 *or* BR_75
2 *or* BR_100
3 *or* BR_110
4 *or* BR_134
5 *or* BR_200
6 *or* BR_300
7 *or* BR_600
8 *or* BR_1200
9 *or* BR_1800
10 *or* BR_2000
11 *or* BR_2400
12 *or* BR_3600
13 *or* BR_4800
14 *or* BR_9600
15 *or* BR_19200
16 *or* BR_38400
CHAR_RATE (?)
0 *or* LOW
1 *or* MEDIUM
2 *or* HIGH
DATA_BITS (?)
0 *or* B_5
1 *or* B_6
2 *or* B_7
3 *or* B_8
PARITY (?)
0 *or* NONE
1 *or* ODD
2 *or* EVEN

STOP_BITS (?)
0 *or* B_1
1 *or* B_1_5
2 *or* B_2
USER_MSG (?)
n1,n2,n3,.......,n? — A list of between 1 and 64 characters.
CTRL_LINES (?) — Set Control Lines.
b

		RS232		V35		RS449		X21	
		DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
Bit	0 =	RTS	CTS	RTS	CTS	RS	CS	C	I
	1 =	DTR	DSR	.	.	.	.	.	.
	2 =	RL	TM	.	.	.	.	.	.
	3 =	LL	RLSD	.	.	.	.	.	.
	4 =	.	.	.	.	.	.	.	.
	5 =	.	.	.	.	.	.	.	.
	6 =	.	.	.	.	.	.	.	.
	7 =	.	.	.	.	.	.	.	.

CTRL_DELAY (?) — Set or Read RTS-CTS delay mode.
0 *or* STOP
1 *or* EXEC

TX_DIAL — **Dial a number.**

TX_DIAL — The number is defined using the TX_PCM:SIGNAL commands

TX_ERROR — **Set or Read the Transmitter error injection parameters.**

TX_ERROR (?)
STATUS (?)
0 *or* DISABLE
1 *or* ENABLE
MODE (?)
0 *or* MANUAL
1 *or* AUTO
TARGET (?)
0 *or* FRAMING
1 *or* CRC
2 *or* PATTERN
3 or ANY_BIT
4 or FRAMING_2M
5 or FRAMING_8M
6 or FRAMING_34M
7 or FRAMING_140M
8 or CODE
TYPE (?)
0 *or* BIT
1 *or* BPV
2 *or* BEFORE_CRC
3 *or* AFTER_CRC
4 or ALL_FW_BITS
LENGTH (?)
0 *or* SINGLY
1 *or* BURSTS
2 *or* CRC_BLOCKS

BURST_SIZE (?)
0 *or* BS_8
1 *or* BS_16
2 *or* BS_32
3 *or* BS_64
4 *or* BS_128
5 *or* BS_256

BURST_RATE (?) — Error inject rate.
r

RATE (?) — Error inject rate.
r

CRC_BLK_TYPE (?)
0 *or* USER
1 *or* ES
2 *or* SES
3 *or* DM

CRC_BLK_ERR (?)
n (0-999)

CRC_BLK_SIZE (?)
0 *or* N1000
1 *or* N60000

TX_INFO — **Reads the Tx status information**

TX_INFO ?
DATA ?
STATUS
0 or OFF
1 or ON
2 or AIS
CLOCK
0 or PRESENT
1 or ABSENT
PCM ?
STATUS
0 or OFF
1 or ON
2 or AIS
CLOCK
0 or PRESENT
1 or ABSENT
SDATA ?
USER_RATE ?
d
CLOCK_SIGNAL ?
0 or PRESENT
1 or ABSENT
DATA_SIGNAL ?
0 or PRESENT
1 or ABSENT
FRAME_SYNC ?
0 or ACHIEVED
1 or LOST

TX_MODE — **Set or Read Tx mode of operation**

TX_MODE (?)
0 or PCM
1 or DATA
2 or SDATA
3 or PCM_SDATA

TX_OFF **Turn Transmitter off.**

TX_OFF

TX_ON **Turn Transmitter on.**

TX_ON

TX_PCM **Set or Read Tx PCM setup.**

TX_PCM ?
CONFIGURE ? Set or Read Tx PCM Interface Parameters.

AIS (?)
0 *or* OFF
1 *or* ON
SYSTEM (?)
0
1 *or* S704K
2 *or* T1SF
3 *or* T1SFNS
4 *or* T1DM
5 *or* T1ESF
6 *or* T1ESFNS
7 *or* T1SLC96
8
9 or S256K
10 or S512K
11 or S1024K
12 *or* S2M
13 *or* S2MNOMF
14 *or* S2MCRC
15 *or* S2MCNOMF
16 *or* S2M32FR
17
18
19 *or* T1CM1
20 *or* T1CM2
21 *or* T2ASYNC
22 *or* T2SYNC
23 *or* S6MIW
24
25 *or* S8M742
26 *or* S8M745
27 *or* S8M744
28 *or* S8M741
29 *or* S34MUF
30 or S140MUF
31 *or* NON_STD
BANK (?)
0 *or* D1D
1 *or* D2
2 *or* D3D4
MODE (?)
0 *or* UNFRAMED
1 *or* FRAMED
2 *or* CHANNEL
3 *or* NX64
4 *or* TRIB1
5 *or* TRIB2
6 *or* TRIB3

- 7 *or* TRIB4
- 8 *or* DROP_INSERT
- 9 *or* NX64_DROP

BIT_RATE (?)

f	kbits/s

PATTERN (?)

- 0 *or* QRSS
- 1 *or* PRBS
- 2 *or* WORD
- 3 *or* WORD_8BIT
- 4 *or* WORD_16BIT
- 5 *or* WORD_24BIT
- 6 *or* VOICE
- 7 *or* DATA
- 8 or STRUCT_DAT
- 9 *or* ONES
- 10 *or* ZEROS
- 11 *or* ALTERNATE
- 12 *or* ONEKHZ
- 13 *or* TWOWORD

PRBS_LEN (?)

0 *or* TWO_9	(PRBS length 2^9-1).
1 *or* TWO_11	
2 *or* TWO_15	
3 *or* TWO_18	
4 *or* TWO_20	
5 *or* TWO_23	
6 *or* TWO_25	
7 *or* TWO_28	
8 or TWO_31	

PRBS_SENSE (?)

- 0 *or* TRUE
- 1 *or* INVERT

PRBS_LIMIT (?)

- 0 *or* NONE
- 1 *or* SEVEN
- 2 *or* FOURTEEN

PRBS_OCTET (?)

0 *or* MODE_7P1	(7 prbs bits + 1 fixed bit).
1 *or* ALL_8	

WORD (?)

- b
- b = programmable word

DATA_CODE (?)

- 0 *or* CODIR
- 1 *or* CONTRA
- 2 *or* DS0
- 3 *or* NRZ
- 4 *or* X21
- 5 *or* V35
- 6 *or* RS449

DATA_TIMED(?)

- 0 *or* FROM_RX
- 1 *or* FROM_TX

CHANNEL (?)

n	Number (limits depend on SYSTEM).

NX64 (?)

b	32_Bits (LSB = channel 1).

FILL_PATN (?)

0 *or* TWO_15	(2^{15}-1 PRBS Fill pattern).

1 *or* WORD 8-bit word
FILL_WORD (?)
b
b = 8 bit word.
CLOCK_SOURCE (?)
0 *or* INTERNAL
1 *or* EXTERNAL
2 *or* RECEIVER
3 *or* EXT_TTL
4 *or* EXT_34M
5 or EXTERNAL_140M
CLOCK_MODE (?)
0 *or* VARIABLE
1 *or* FIXED
CLOCK_OUTPUT (?)
0 *or* TRUE
1 *or* INVERT
LINE_CODE (?)
0 *or* AMI
1 *or* HDB3
2 *or* B8ZS
3 *or* B6ZS
4 or CMI
5 or TTL
6 or ECL
CLOCK_RATE (?)
f kHz
CLOCK_OFFSET (?)
n ppm
AIS_ZEROS (?)
0 *or* NONE
1 *or* RATE
AIS_RATE (?)
r
LEVEL (?)
0 *or* CABLE_SIM
1 *or* NORMAL
LOOPBACK ? Set or Read Transmitter loopback.
MAKE_A_LEN (?)
n
(n = number of bits in the loopback 'Make A' pattern).
MAKE_A_PATN (?)
b
(b = loopback 'Make A' pattern).
BREAK_A_LEN (?)
n
(n = number of bits in the loopback 'Break A' pattern).
BREAK_A_PATN (?)
b
(b = loopback 'Break A' pattern).
MAKE_B_LEN (?)
n
(n = number of bits in the loopback 'Make B' pattern).
MAKE_B_PATN (?)
b
(b = loopback 'Make B' pattern).
BREAK_B_LEN (?)
n
(n = number of bits in the loopback 'Break B' pattern).
BREAK_B_PATN (?)

b
(b = loopback 'Break B' pattern).
MODE (?)
0 *or* OFF
1 *or* MAKE_A
2 *or* BREAK_A
3 *or* MAKE_B
4 *or* BREAK_B

SEQUENCE ?	Set or Read the Transmitter sequence test parameters.
FRAME_NO (?)	
0 *or* ALL	(Number of frames).
1 *or* ONE	
2 *or* TWO	
3 *or* THREE	
4 *or* FOUR	
5 *or* FIVE	
MF_NO (?)	
0 *or* ALL	(Number of multiframes).
1 *or* ONE	
2 *or* TWO	
3 *or* THREE	
YELLOW (?)	
0 *or* OFF	
1 *or* ON	
FRAME_ALARM (?)	
0 *or* STOP	
1 *or* EXECUTE	(Execute).
MF_ALARM (?)	
0 *or* STOP	
1 *or* EXECUTE	
AIS_64_ALARM (?)	
0 *or* STOP	
1 *or* EXECUTE	
TS16_ALARM (?)	
0 *or* STOP	
1 *or* EXECUTE	
SIGNAL ?	Set or Read the Transmitter signalling parameters.

MODE (?)
0 *or* CHANNEL
1 *or* DTMF
2 *or* C_BIT
CHANNEL (?)
n
(n = Number of channel limits depend on system).
SIG_CODE (?)
b
(b = 2-Bit word/4-Bit word depending on system).
OTHER_CODE (?)
b
(b = 2-Bit word/4-Bit word depending on system).
DTMF_CHANNEL (?)
n
DTMF_MODE (?)
0 *or* DIAL
1 *or* SINGLE
TONE_ON (?)
n mSecs
TONE_OFF (?)

n	mSecs
PAUSE_DURAT (?)	
n	mSecs
NEW_NUMBER (?)	
s	up to 19 digits.
C_BITS(?)	
b	Set or Read C-bit framing.
MUX?	Set or Read the MUX parameters
MODE(?)	
0 *or* ON	
1 *or* OFF	
FROM(?)	Mux from base system.
0 *or* S2M	
1 *or* S8M	
2 or S34M	
TO(?)	Mux to line system.
0 *or* S8M	
1 *or* S34M	
2 or S140M	
CLOCK_SOURCE(?)	
0 *or* INTERNAL	
1 *or* EXTERNAL	
2 or RECEIVER	
CLOCK_OFFSET(?)	
n	ppm
CLOCK_OUTPUT(?)	
0 *or* TRUE	
1 *or* INVERT	
LINE_CODE(?)	
0 *or* AMI	
1 *or* HDB3	
2	
3	
4 or CMI	
5 or TTL	
6 or ECL	
TRIB_34M(?)	
n	
FILL_PAT_34M(?)	
0 *or* ONES	
1 *or* ZEROS	
2 *or* ALTERNATE	
3 *or* PRBS	
4 *or* COPY	
TRIB_8M(?)	
n	
FILL_PAT_8M(?)	
0 *or* ONES	
1 *or* ZEROS	
2 *or* ALTERNATE	
3 *or* PRBS	
4 *or* COPY	
TRIB_2M(?)	
n	
FILL_PAT_2M(?)	
0 *or* ONES	
1 *or* ZEROS	
2 *or* ALTERNATE	
3 *or* PRBS	
4 *or* COPY	

MUX_SEQUENCE? — Set or Read the MUX sequence test parameters.

NO_140M(?)
- 0 *or* ALL
- 1 *or* ONE_IN_6
- 2 *or* TWO_IN_6
- 3 *or* THREE_IN_6
- 4 *or* FOUR_IN_6
- 5 *or* FIVE_IN_6

ALARM_140M(?)
- 0 *or* STOP
- 1 *or* CONTINUOUS
- 2 or SINGLE

NO_34M(?)
- 0 *or* ALL
- 1 *or* ONE_IN_6
- 2 *or* TWO_IN_6
- 3 *or* THREE_IN_6
- 4 *or* FOUR_IN_6
- 5 *or* FIVE_IN_6

ALARM_34M(?)
- 0 *or* STOP
- 1 *or* CONTINUOUS
- 2 or SINGLE

NO_8M(?)
- 0 *or* ALL
- 1 *or* ONE_IN_6
- 2 *or* TWO_IN_6
- 3 *or* THREE_IN_6
- 4 *or* FOUR_IN_6
- 5 *or* FIVE_IN_6

ALARM_8M(?)
- 0 *or* STOP
- 1 *or* CONTINUOUS
- 2 or SINGLE

MUX_OVERHEAD(?) — Set or read the Tx Mux overhead bits

b
- 0 = 8M A bit
- 1 = 8M N BIT
- 2 = 34M A bit
- 3 = 34M N bit
- 4 = 140M A bit
- 5 = 140M 1st N bit
- 6 = 140M 2nd N bit
- 7 = 140M 3rd N bit

OVERHEAD(?) — Set or Read the Tx overhead bits.

b1,b2

PCM system	b1 Bits FEDCBA9876543210	b2 Bits 76543210
S704K	I.......INAUUUUU	....PLPP
T1SF	....	....
T1SFNS	....	....
T1DM	....	.....YA.
T1ESF	MMMMMMMMMMMMMMMM	....
T1ESFNS	MMMMMMMMMMMMMMMM	....
T1SLC96	...CCCAALLLL....	....
S2M	I.......INAUUUUU	....PLPP
S2MNOMF	I.......INAUUUUU	....
S2MCRC	.........NAUUUUU	....PLPP
S2MCNOMF	.........NAUUUUU	....
S2M32FR	I.......INAUUUUU	....PLPP
T1CM1	....	....
T1CM2	....	.......Y

```
T2ASYNC   ................   .......Y
T2SYNC    ................   .......Y
S6MIW     .........N......   .......Y
S8M742    .........N......   ......A.
S8M745    ....SSSS........   ....UUAU
S8M744    ................   ......AS
S8M741    KKKKKKKKKKKKKKKK   ......AS
```

TX_SDATA **Set or Read Tx Structured Data setup**

TX_SDATA?
- INTERFACE(?)
  - 0 or BIN_TTL
  - 1 or BAL_V.11
  - 2 or BAL_120
  - 3 or PCM_CHANNEL
- LINE_CODE(?)
  - 0 or NRZ
  - 1 or CO_DIR
  - 2 or CONTRA
  - 3 or AMI_50
  - 4 or AMI_100
  - 5 or BIP_MARK
  - 6 or BIP_SPACE
- STRUCTURE(?)
  - 1 or X50_80CH
  - 2 or X50_20CH
  - 3 or UNSTRUCTURED
  - 4 or STRUCT_8BIT
  - 5 or STRUCT_7BIT
  - 6 or S6_PLUS_2
- BIT_RATE(?)
  - nnn.nnn kbit/s (32 to 150)
- DROP_INSERT(?)
  - 0 or OFF
  - 1 or ON
- DI_INTERFACE(?)
  - 0 or BIN_TTL
  - 1 or BAL_V.11
  - 2 or BAL_120
  - 3 or PCM_CHANNEL
- DI_LINE_CODE(?)
  - 0 or NRZ
  - 2 or CO_DIR
  - 3 or CONTRA
  - 4 or AMI_50
  - 5 or AMI_100
  - 6 or BIP_MARK
  - 7 or BIP_SPACE
- CLOCK_SRC(?)
  - 0 or INTERNAL
  - 1 or BIN_TTL
  - 2 or BAL_V11
  - 3 or BAL_120
  - 4 or CONTRA
  - 5 or RX_TIMING
  - 6 or BIN_TTL_X16
  - 7 or BAL_V11_2M
  - 8 or BAL_120_2M
  - 9 or RECEIVED_DI
- CLK_SRC_POL(?)
  - 0 or TRUE
  - 1 or INVERT
- ALIGN_LOCK(?)
  - 0 or OFF
  - 1 or ON

CLOCK_OUT(?)		
	0 or NONE	
	1 or BIN_TTL	
	2 or BAL_V11	
	3 or BAL_120	
	4 or CONTRA	
CLK_OUT_POL(?)		
	0 or TRUE	
	1 or INVERT	
DATA_RATE(?)		
	0	
	1 or DR_600	
	2 or DR_1200	
	3 or DR_2400	
	4 or DR_4800	
	5 or DR_9600	
	6 or DR_14400	
	7 or DR_19200	
	8 or DR_48000	
	9 or USER	
X50_CHANNEL(?)		
	n	Channel number
X50_CH_PAIR(?)		
	0 or CHAN_1_2	
	1 or CHAN_1_3	
	2 or CHAN_1_4	
	3 or CHAN_1_5	
	4 or CHAN_2_3	
	5 or CHAN_2_4	
	6 or CHAN_2_5	
	7 or CHAN_3_4	
	8 or CHAN_3_5	
	9 or CHAN_4_5	
	10 or CHAN_5_4	
X50_CH_MASK(?)		
	80 bits	
TEST_PATTERN(?)		
	0	
	1 or ONES	
	2 or ZEROS	
	3 or ALTERNATE	
	4 or PRBS_N	
	5 or WORD_12BIT	
	6 or WORD_16BIT	
PRBS_LEN(?)		
	n	Length
PRBS_SENSE(?)		
	0 or TRUE	
	1 or INVERT	
WORD(?)		
	n bits	Word value
WORD_LEN(?)		
	n	Word length
X50_FILL_PAT(?)		Fill pattern
	0 or ONES	
	1 or ZERO	
	2 or PRBS	PRBS 2^7-1
X50_FILL_ST(?)		Fill status
	1 bit	
STATUS_MODE(?)		

	0 or UNFRAMED	
	1 or FRAMED	
	2 or COMMAND	
	3 or RESPONSE	
STATUS_CODE(?)		
	0 or OBSERVATION	
	1 or LOOPBACK_2	
	2 or LOOPBACK_3	
	3 or NORMAL	
	4 or UNAVAILABLE	
	5 or EQUIP_FAULT	
	6 or LOOPBACK	
	7 or LINE_FAULT	
STATUS_BIT(?)		
	1 bit	
STATUS_WORD(?)		
	7 bits	
DIST_BIT_A(?)		
	1 bit	0 = Alarm (X.50)
H_KEEP_BH(?)		X.50 80 channel
	7 bits	Housekeeping bits B to H
ERR_INJECT(?)		
	0 or DISABLE	
	1 or ENABLE	
ERR_RATE(?)		Error injection rate
	0 or MANUAL	
	1 or TEN_2	1 in 10^2
	2 or TEN_3	1 in 10^3
	3 or TEN_4	1 in 10^4
	4 or TEN_5	1 in 10^5
	5 or TEN_6	1 in 10^6
	6 or TEN_7	1 in 10^7
	7 or TEN_8	1 in 10^8
ERR_TARGET(?)		Target for error injection
	0 or PATTERN	
	1 or FRAMING	
	2 or ENVELOPE	
	3 or BIT	
ERR_BIT(?)		Inject error into bit number
	n	n = bit number 1 to 12 for 12 bit word or n = bit number 1 to 16 for 16 bit word.
AIS_LENGTH(?)		Length of injected AIS
	nn.nn	secs. (0.01 to 99.99).
AIS_MODE(?)		
	0 or STOP	
	1 or EXECUTE	
IN_THRESH(?)		
	n.nn	Volts (0.1 to 1.50 V)
OUT_THRESH(?)		
	n.nn	Volts (0.01 to 1.50 V)
PATTERN_MASK(?)		Set or read the pattern mask bits.
	8 bits	

UPDATE_INT — **Last results update interval.**

UPDATE_INT(?)

- 0 *or* T15_MINS
- 1 *or* T30_MINS
- 2 *or* T1_HOUR

3 *or* T6_HOURS
4 *or* T12_HOURS
5 *or* T24_HOURS

USER_OPTIONS — **Set or Read user options.**

USER_OPTIONS ?
CURSOR_SKIP (?)
0 *or* DISABLE (Autoskip)
1 *or* ENABLE
LANGUAGE (?)
0 *or* ENGLISH
1 *or* FRENCH
2 *or* ITALIAN
3 *or* SPANISH
VOICE_ENCODE (?)
0 *or* MU_LAW (Voice encoding law).
1 *or* A_LAW
LED_ERR_THR (?)
r
EXCESS_ZEROS (?)
0 *or* DISABLE
1 *or* ENABLE

VOLUME — **Set the loudspeaker volume value.**

VOLUME n
Range 1 to 16.

***CLS** — **Clear summary registers.**

*CLS
Clears Transmitter/Receiver Summary (TXRX_SUMMARY),
Measurement Summary (ME_SUMMARY),
Instrument Errors Summary (IE_SUMMARY),
Mux Summary (MUX_SUMMARY),
Structured Data Measurement Summary (SDME_SUMMARY),
Structured Data Transmitter Summary (SDTX_SUMMARY),
Structured Data Receiver Summary (SDRX_SUMMARY),
Event Status register (*ESR)

Note **The status registers take a finite time to clear & hence if *CLS is immediately followed by a serial poll the status byte may not be cleared. Use *OPC? to ensure *CLS has been completed.**

***ESE** — **Set or Read the Standard Event Status Enable mask.**

*ESE (?)
b
Bit 0 = Operation complete.
1 =
2 = Read instruction error.
3 = Device dependant error.
4 = Execution error.
5 = Command error.
6 =
7 = Power on.

Set a bit to a one to enable reading the equivalent bit in the Event Status register. (See Fig. 4-13)

***ESR** — **Read Standard Event Status register**

*ESR ? (See Fig. 4-13)

***IDN** — **Read identification.**

*IDN ?

Returns-
IFR,
2851 and 2851S,
0,
xxx
(where xxx is the software version number e.g. 001)

***LRN** — **Read 2851 settings.**

*LRN ? — The equivalent of sending -

TX_MODE?;RX_MODE?;TX_PCM:CONFIG?;LOOPBACK?;SEQUENCE:FRAME_NO?;MF_NO?;SIGNAL?;MUX?;MUX_SEQUENCE?;MUX_OVERHEAD?;OVERHEAD?;RX_PCM:CONFIG?;SIGNAL:MODE?;CHANNEL?;DTMF_CHANNEL?;LINE:IMPEDANCE?;DEMUX?;TX_DATA?;RX_DATA:CONFIG?;ASYNC?;TX_SDATA?;RX_SDATA?;TX_ERROR?;TEST:LIMITS?;LIMITS_G821?;LIMITS_G826?;LIMITS_M2100?;THRESHOLD;PARAMETERS?;SETUP?;SD_LOOPBACK:CONFIGURE?;CONFIG_SIG?;USER_OPTIONS?;AUTO_PRINT?;PRINTER_PORT?;SWITCH:DATA_PORT?;PCM_PORT?;OUT_FORMAT?;HEADER?;SIG_DIGITS?;FORMAT?;ME_MASK?;TXRX_MASK?;IE_MASK?;MUX_MASK?;SD_MASK?;SDME_MASK?;SDRX_MASK?;SDTX_MASK?;THRESHOLD?;BRQ_CHAR?;UPDATE_INT?;*ESE?;*PSC?;*SRE?

The returned string can be retransmitted to the 2851.

***OPC** — **Operation complete command.**

*OPC		Sets OPC bit in ESR register when all previous commands have been completed.
*OPC ?	n	Returns a value of '1' when all previous commands have been completed (See Program Synchronization Page 4-16).

***OPT** — **Read 2851 hardware options.**

*OPT ?	n1,n2,n3,n4	
	n1 = 0 *or* AD99_04	Receiver Card Fitted.
	1 *or* AD11_ENG	
	2 *or* AD12_ENG	
	3 *or* AD99_07	
	4 *or* AD12_05	
	5 *or* AD12_06	
	6 *or* ID06	
	7 *or* ID07	
	8 *or* AD11_01	
	9 *or* AD11_03	
	10 *or* AD11_02	
	11 *or* ID11	
	12 *or* ID12	
	13 *or* ID13	
	14 *or* AD98_25	
	15 *or* NO_RX_BD	
	n2 = 0 *or* NONE	Gpib.
	1 *or* FITTED	
	n3 = 0 *or* NONE	Option Card.
	1 *or* UNFRAMED_34M	
	2 *or* FRAMED_34M	
	3 or FRAMED_140M	
	4 or SDATA_TYPE1	
	n4 = 0 Spare.	

***PSC** — **Set or Clear power-on clear status.**

*PSC (?)		n Controls the clearing of SRE and ESR registers on power-up.
	n = 0	Sets PON bit in ESR register. (Registers not cleared on power-up).
	n <> 0	Any other number clears registers on power-up.

***RST** — **Reset 2851.**

*RST ?

The equivalent of sending-
STOP;STORE:FIXED_RECALL_DEFAULT;HEADER DEFAULT;
OUT_FORMAT DECIMAL;SIG_DIGITS 6;
FORMAT OFF;THRESHOLD 1.E-4<lf>

***SRE** — **Set or Read the Service Request Enable mask.**

*SRE (?)

b
Bit 0 = Transmit/Receive summary bit (TXRX_S).
1 = Measurement summary bit (ME_S).
2 = Instrument errors summary bit (IE_S).
3 = Mux summary bit (MUX_S).
4 = Message available (MAV).
5 = Event summary bit (ESB).
6 = Request service (RQS)/Master summary status (MSS).
7 = Structured data summary bit (SD_S)

Set a bit to zero to inhibit reading the equivalent bit in the Status byte. (See Fig. 4-14).

***STB** — **Read status byte.**

*STB ? — (See Fig. 4-14).

***TRG** — **Device trigger.**

*TRG — Executes macro 1.

Note...

This command has the same effect as sending 'ME 1', <GET> on the GPIB interface or ^H on the RS232 interface

***TST** — **Read power-on self-test result.**

*TST ? b — Bit set indicates error

Bit 0 = Battery error.
1 = Configuration RAM error.
2 = Stored results error.
3 = Configuration stores error.
4 = AE1 Interface error.
5 = Structured data card interface failure

***WAI** — **Wait to continue command.**

*WAI — Waits for all previous commands to be completed before decoding further commands. (See program sychronization page 4-16).

COMMAND FORMATS

Table 4-1 Data type options

Data type	Default returned data type	Alpha	Dec	Hex	Oct	Bin	Def	Indef	Str	Dec nr1	Dec nr2	Dec nr3	Arb asc
1	Decimal	X	X	X	X	X	.	.	.	X	.	.	.
2	Decimal	.	X	.	.	.	.	.	.	X	X	X	.
3	Arbitrary ascii	.	.	.	.	.	.	.	X	.	.	.	.
4	Fixed point	.	X	.	.	.	.	.	.	.	X	X	.
5	Floating point	.	X	.	.	.	.	.	.	.	X	X	.
6	Decimal	.	X	.	.	.	.	.	.	X	.	.	.
7	String	.	.	.	.	.	.	.	X	.	.	.	.
8	Decimal	.	X	X	X	X	.	.	X	X	.	.	.
9	Decimal	X	X	.	.	.	.	.	.	X	.	.	.
10	Hex	.	X	X	X	X	.	.	.	X	.	.	.
11	Binary	.	X	X	X	X	.	.	X	X	.	.	.
12	Floating point	.	X	.	.	.	.	.	.	X	X	X	.
13	Decimal	.	X	X	X	X	.	.	.	X	.	.	.

COMMAND MNEMONIC	<----------send data---------	------>	<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
ALARMS	n/a	No data	n/a	MINIMUM
DATA	n/a	No data	n/a	MINIMUM
LOCK	n/a	No data	8	OFF
NOW	n/a	No data	8	OFF
RESET	No data	n/a	n/a	OFF
DEMUX_140M	n/a	No data	n/a	MINIMUM
LOCK	n/a	No data	8	OFF
NOW	n/a	No data	8	OFF
RESET	No data	n/a	n/a	OFF
DEMUX_34M	n/a	No data	n/a	MINIMUM
LOCK	n/a	No data	8	OFF
NOW	n/a	No data	8	OFF
RESET	No data	n/a	n/a	OFF
DEMUX_2M	n/a	No data	n/a	MINIMUM
LOCK	n/a	No data	8	OFF
NOW	n/a	No data	8	OFF
RESET	No data	n/a	n/a	OFF
PCM	n/a	No data	n/a	MINIMUM
LOCK	n/a	No data	8	OFF
NOW	n/a	No data	8	OFF
RESET	No data	n/a	n/a	OFF
SDATA	n/a	No data	n/a	MINIMUM
LOCK	n/a	No data	8	OFF
NOW	n/a	No data	8	OFF
RESET	No data	n/a	n/a	OFF

COMMAND MNEMONIC	<----------send data---------> <-non query->	<---query--->	<--return data-->	<-header-> <-default->
AUTO_PRINT	n/a	No data	n/a	MINIMUM
EVENT	n/a	No data	n/a	MINIMUM
STATUS	1	No data	1	OFF
ALARMS	1	No data	1	OFF
ERRORED_SECS	1	No data	1	OFF
SIGNALLING	1	No data	1	OFF
RATIO	4	No data	4	OFF
THRESHOLD	1	No data	1	OFF
PERF_LIMITS	1	No data	1	OFF
INTERVAL	n/a	No data	n/a	MINIMUM
STATUS	1	No data	1	OFF
TIME	1	No data	1	OFF
MAJOR_ERRORS	1	No data	1	OFF
OTHER_ERRORS	1	No data	1	OFF
DEMUX_ERRORS	1	No data	1	OFF
SDATA	1	No data	1	OFF
G821	1	No data	1	OFF
G826	1	No data	1	OFF
STORED_RES	1	No data	1	OFF
SYNC_SLIPS	1	No data	1	OFF
BRQ_CHAR	1	No data	1	OFF
COMM_ERROR	n/a	No data	13	OFF
CONFIG_SIG	n/a	No data	n/a	MINIMUM
BREAK_MIN	2	No data	2	OFF
BREAK_MAX	2	No data	2	OFF
MAKE_MIN	2	No data	2	OFF
MAKE_MAX	2	No data	2	OFF
PAUSE_MIN	2	No data	2	OFF
BREAK_CODE	8	No data	8	OFF
MAKE_CODE	8	No data	8	OFF
DIAL_MAPPING	1	No data	1	OFF
DATE	6,6,6	No data	6,6,6	OFF
DELAY	2	No data	n/a	OFF
DEV_ERROR	n/a	No data	13	OFF
DISPLAY	1	n/a	n/a	OFF
ERR_DIST	n/a	No data	n/a	MINIMUM
CURSOR_POS	6,6,6,6,6	No data	6,6,6,6,6	OFF
ERR_TYPE	n/a	No data	1	OFF
ERR_HOURS	n/a	No data	12,12,12	OFF
ERR_MINS	n/a	No data	12,12,12	OFF
INC_MIN	No data	n/a	n/a	OFF
INC_MIN_15	No data	n/a	n/a	OFF
DEC_MIN	No data	n/a	n/a	OFF
DEC_MIN_15	No data	n/a	n/a	OFF
INC_HR	No data	n/a	n/a	OFF
INC_HR_15	No data	n/a	n/a	OFF
DEC_HR	No data	n/a	n/a	OFF
DEC_HR_15	No data	n/a	n/a	OFF
FIRST	No data	No data	6,6,6,6,6	OFF
LAST	No data	No data	6,6,6,6,6	OFF
STAT_HR	n/a	No data	6,6,6	OFF
STAT_MIN	n/a	No data	6,6,6	OFF
EXEC_ERROR	n/a	No data	13	OFF
FORMAT	1	No data	1	OFF
G821_HIST	n/a	No data	n/a	MINIMUM
CURSOR_POS	6,6,6,6,6	No data	6,6,6,6,6	OFF
ERR_TYPE	n/a	No data	1	OFF
DM_INT_LIM	n/a	No data	2	OFF

COMMAND MNEMONIC	<----------send data----------	--------->	<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
DM_INT_TOT	n/a	No data	2	OFF
DM_PER_LIM	n/a	No data	2	OFF
DM_PER_TOT	n/a	No data	2	OFF
ES_INT_LIM	n/a	No data	2	OFF
ES_INT_TOT	n/a	No data	2	OFF
ES_PER_LIM	n/a	No data	2	OFF
ES_PER_TOT	n/a	No data	2	OFF
SES_INT_LIM	n/a	No data	2	OFF
SES_INT_TOT	n/a	No data	2	OFF
SES_PER_LIM	n/a	No data	2	OFF
SES_PER_TOT	n/a	No data	2	OFF
BRK_INT_TOT	n/a	No data	2	OFF
BRK_PER_TOT	n/a	No data	2	OFF
PER_UNAVAIL	n/a	No data	5	OFF
INC	No data	n/a	n/a	OFF
DEC	No data	n/a	n/a	OFF
FIRST	No data	No data	6,6,6,6,6	OFF
LAST	No data	No data	6,6,6,6,6	OFF
STATUS	n/a	No data	6,6,6	OFF
GPIB_PORT	n/a	No data	n/a	MINIMUM
INTERFACE	1	No data	1	OFF
MODE	1	No data	1	OFF
ADDRESS	6	No data	6	OFF
HEADER	1	No data	1	OFF
IE_MASK	8	No data	8	OFF
IE_MSUMM	n/a	No data	8	OFF
IE_SUMMARY	n/a	No data	8	OFF
INJECT	No data	n/a	n/a	OFF
ISDN_LOCK	n/a	No data	8,8,8,8	OFF
ISDN_NOW	n/a	No data	8,8,8,8	OFF
ISDN_RESET	No data	n/a	n/a	OFF
LAMP_LOCK	1	n/a	n/a	OFF
LAST_RESULTS	n/a	No data	n/a	MINIMUM
BITSLIPS	n/a	No data	n/a	MINIMUM
MAIN_FREQ	n/a	No data	5	OFF
SLIP_FREQ	n/a	No data	5	OFF
SLIP_COUNT	n/a	No data	2	OFF
SLIP_TOTAL	n/a	No data	2	OFF
BURSTS	n/a	No data	n/a	MINIMUM
TOTAL	n/a	No data	2	OFF
INTERVAL	n/a	No data	5	OFF
SINCE	n/a	No data	5	OFF
MAJOR	n/a	No data	n/a	MINIMUM
ERROR_TYPE	n/a	No data	1	OFF
TOTAL_ERRORS	n/a	No data	2	OFF
MEAN_ERR_RAT	n/a	No data	4	OFF
CURRENT_RAT	n/a	No data	4	OFF
RESIDUAL_RAT	n/a	No data	4	OFF
OTHERS	n/a	No data	n/a	MINIMUM
CODE	n/a	No data	2,4	OFF
PATTERN	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
FRAME_BIT	n/a	No data	2,4	OFF
CRC	n/a	No data	2,4	OFF

COMMAND MNEMONIC	<----------send data--------->		<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
DEG_MINS	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_GOOD_MIN	n/a	No data	5	OFF
PER_BAD_MIN	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
BREAKS	n/a	No data	2	OFF
SLIPS	n/a	No data	n/a	MINIMUM
POS_OCTET	n/a	No data	2	OFF
NEG_OCTET	n/a	No data	2	OFF
INTERVAL	n/a	No data	2	OFF
SINCE	n/a	No data	2	OFF
SYNC	n/a	No data	n/a	MINIMUM
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
NO_PATT_SYNC	n/a	No data	2,2	OFF
NO_CRC_SYNC	n/a	No data	2,2	OFF
DEMUX_140M	n/a	No data	n/a	MINIMUM
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
FRAME_BIT	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
SYNC	n/a	No data	n/a	MINIMUM
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
DEMUX_34M	n/a	No data	n/a	MINIMUM
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
FRAME_BIT	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
SYNC	n/a	No data	n/a	MINIMUM

COMMAND MNEMONIC	<----------send data---------	><--return data-->		<-header->
	<-non query->	<---query--->		<-default->
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
DEMUX_8M	n/a	No data	n/a	MINIMUM
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
FRAME_BIT	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
SYNC	n/a	No data	n/a	MINIMUM
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
DEMUX_2M	n/a	No data	n/a	MINIMUM
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
FRAME_BIT	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
SYNC	n/a	No data	n/a	MINIMUM
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
SDATA	n/a	No data	n/a	MINIMUM
PATTERN_PER	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
FRAMING_PER	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF

COMMAND MNEMONIC	<----------send data----------> <-non query->	<---query--->	<--return data-->	<-header-> <-default->
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
PATTERN	n/a	No data	2,4,2	OFF
FRAMING	n/a	No data	2,4,2	OFF
SYNC	n/a	No data	n/a	MINIMUM
SIGNAL	n/a	No data	2,2	OFF
FRAMING	n/a	No data	2,2	OFF
PATTERN	n/a	No data	2,2	OFF
MC	6	n/a	n/a	OFF
ME	6	n/a	n/a	OFF
ME_MASK	8	No data	8	OFF
ME_MSUMM	n/a	No data	8	OFF
ME_SUMMARY	n/a	No data	8	OFF
MS	6,7	6	No data	OFF
MUX_MASK	8	No data	8	OFF
MUX_MSUMM	n/a	No data	8	OFF
MUX_SUMMARY	n/a	No data	8	OFF
OUT_FORMAT	1	No data	1	OFF
PERCENT_PERF	1	No data	1	OFF
POWER_DOWN	n/a	No data	6,6,6,6,6,6	OFF
POWER_UP	n/a	No data	6,6,6,6,6,6	OFF
PRINT	No data	n/a	n/a	OFF
PRINTER_PORT	n/a	No data	n/a	MINIMUM
TYPE	1	No data	1	OFF
TERMINATOR	1	No data	1	OFF
IDENTITY_NO	6	No data	6	OFF
LABEL	7	No data	7	OFF
QUE_ERROR	n/a	No data	13	OFF
RESULTS	n/a	No data	n/a	MINIMUM
BITSLIPS	n/a	No data	n/a	MINIMUM
MAIN_FREQ	n/a	No data	5	OFF
SLIP_FREQ	n/a	No data	5	OFF
SLIP_COUNT	n/a	No data	2	OFF
SLIP_TOTAL	n/a	No data	2	OFF
BURSTS	n/a	No data	n/a	MINIMUM
TOTAL	n/a	No data	2	OFF
INTERVAL	n/a	No data	5	OFF
SINCE	n/a	No data	5	OFF
MAJOR	n/a	No data	n/a	MINIMUM
ERROR_TYPE	n/a	No data	1	OFF
TOTAL_ERRORS	n/a	No data	2	OFF
MEAN_ERR_RAT	n/a	No data	4	OFF
CURRENT_RAT	n/a	No data	4	OFF
RESIDUAL_RAT	n/a	No data	4	OFF
OTHERS	n/a	No data	n/a	MINIMUM
CODE	n/a	No data	2,4	OFF
PATTERN	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
FRAME_BIT	n/a	No data	2,4	OFF
CRC	n/a	No data	2,4	OFF
E_BIT	n/a	No data	2,4	OFF
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
DEG_MINS	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF

COMMAND MNEMONIC	<----------send data---------->		<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_GOOD_MIN	n/a	No data	5	OFF
PER_BAD_MIN	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
BREAKS	n/a	No data	2	OFF
PERF_G821	na	No data	n/a	MINIMUM
PER_ES	n/a	No data	5,1,1	OFF
PER_SES	n/a	No data	5,1,1	OFF
PER_BAD_MIN	n/a	No data	5,1,1	OFF
PER_UNAVAIL	n/a	No data	5,1,1	OFF
PERF_G826	na	No data	n/a	MINIMUM
ES_RATIO	n/a	No data	4,1,1	OFF
SES_RATIO	n/a	No data	4,1,1	OFF
BBE_RATIO	n/a	No data	4,1,1	OFF
PER_UNAVAIL	n/a	No data	5,1,1	OFF
PERF_M2100	na	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2,1,1,1	OFF
SES	n/a	No data	2,1,1,1	OFF
UNAVAIL	n/a	No data	2,1,1,1	OFF
SLIPS	n/a	No data	n/a	MINIMUM
POS_OCTET	n/a	No data	2	OFF
NEG_OCTET	n/a	No data	2	OFF
INTERVAL	n/a	No data	2	OFF
SINCE	n/a	No data	2	OFF
SYNC	n/a	No data	n/a	MINIMUM
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
NO_PATT_SYNC	n/a	No data	2,2	OFF
NO_CRC_SYNC	n/a	No data	2,2	OFF
DEMUX_140M	n/a	No data	n/a	MINIMUM
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
FRAME_BIT	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
SYNC	n/a	No data	n/a	MINIMUM
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
DEMUX_34M	n/a	No data	n/a	MINIMUM
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF

COMMAND MNEMONIC	<----------send data---------><-non query->	<---query--->	<--return data-->	<-header-><-default->
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
FRAME_BIT	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
SYNC	n/a	No data	n/a	MINIMUM
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
DEMUX_8M	n/a	No data	n/a	MINIMUM
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
FRAME_BIT	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
SYNC	n/a	No data	n/a	MINIMUM
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
DEMUX_2M	n/a	No data	n/a	MINIMUM
PERFORMANCE	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
FRAME_BIT	n/a	No data	2,4	OFF
FRAME_WORD	n/a	No data	2,4	OFF
SYNC	n/a	No data	n/a	MINIMUM
NO_SIGNAL	n/a	No data	2,2	OFF
AIS_RECEIVED	n/a	No data	2,2	OFF
NO_FRAME_SYN	n/a	No data	2,2	OFF
SDATA	n/a	No data	n/a	MINIMUM
PATTERN_PER	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF

COMMAND MNEMONIC	<----------send data---------> <-non query->	<---query--->	<--return data-->	<-header-> <-default->
FRAMING_PER	n/a	No data	n/a	MINIMUM
ERR_SECS	n/a	No data	2	OFF
SES	n/a	No data	2	OFF
UNAVAIL	n/a	No data	2	OFF
PER_EFS	n/a	No data	5	OFF
PER_ES	n/a	No data	5	OFF
PER_NON_SES	n/a	No data	5	OFF
PER_SES	n/a	No data	5	OFF
PER_AVAIL	n/a	No data	5	OFF
PER_UNAVAIL	n/a	No data	5	OFF
ERRORS	n/a	No data	n/a	MINIMUM
PATTERN	n/a	No data	2,4,2	OFF
FRAMING	n/a	No data	2,4,2	OFF
SYNC	n/a	No data	n/a	MINIMUM
SIGNAL	n/a	No data	2,2	OFF
FRAMING	n/a	No data	2,2	OFF
PATTERN	n/a	No data	2,2	OFF
RES_STATUS	n/a	No data	1	OFF
RS232_PORT	n/a	No data	n/a	MINIMUM
INTERFACE	1	No data	1	OFF
BIT_RATE	1	No data	1	OFF
FORMAT	1	No data	1	OFF
HANDSHAKE	1	No data	1	OFF
RX_DATA	n/a	No data	n/a	MINIMUM
CONFIGURE	n/a	No data	n/a	MINIMUM
SYSTEM	1	No data	1	OFF
MODE	1	No data	1	OFF
INPUT_MODE	1	No data	1	OFF
LINE_CODE	1	No data	1	OFF
BIT_RATE	12	No data	5	OFF
PATTERN	1	No data	1	OFF
PRBS_LEN	1	No data	1	OFF
PRBS_SENSE	1	No data	1	OFF
CLOCK_SOURCE	1	No data	1	OFF
CLOCK_SENSE	1	No data	1	OFF
ASYNC	n/a	No data	n/a	MINIMUM
BIT_RATE	1	No data	1	OFF
DATA_BITS	1	No data	1	OFF
PARITY	1	No data	1	OFF
STOP_BITS	1	No data	1	OFF
USER_MSG	(1-19)<10>	No data	(1-19)<10>	OFF
NPD	n/a	No data	n/a	MINIMUM
MODE	1	No data	1	OFF
TIME	n/a	No data	5	OFF
BITS	n/a	No data	2	OFF
RX_INFO	n/a	No data	n/a	MINIMUM
DATA	n/a	No data	n/a	MINIMUM
CHAR_RATE	n/a	No data	2	OFF
FREQ	n/a	No data	5	OFF
OFFSET	n/a	No data	2	OFF
STATE	n/a	No data	1,1	OFF
WORD	n/a	No data	8	OFF
CTRL_LINES	n/a	No data	11	OFF
CTRL_DELAY	n/a	No data	2	OFF
DEMUX	n/a	No data	n/a	MINIMUM
FREQ_140M	n/a	No data	5	OFF
OFFSET_34M	n/a	No data	2	OFF

COMMAND MNEMONIC	<----------send data---------->		<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
FREQ_34M	n/a	No data	5	OFF
OFFSET_34M	n/a	No data	2	OFF
JUST_34M	n/a	No data	5	OFF
FREQ_8M	n/a	No data	5	OFF
OFFSET_8M	n/a	No data	2	OFF
JUST_8M	n/a	No data	5	OFF
FREQ_2M	n/a	No data	5	OFF
OFFSET_2M	n/a	No data	2	OFF
JUST_2M	n/a	No data	5	OFF
OVERHEAD	n/a	No data	11	OFF
PCM	n/a	No data	n/a	MINIMUM
FREQ	n/a	No data	5	OFF
OFFSET	n/a	No data	2	OFF
OVERHEAD	n/a	No data	11,11,11	OFF
STATE	n/a	No data	1,1	OFF
TONE_LEVEL	n/a	No data	5	OFF
WORD	n/a	No data	8	OFF
SDATA	n/a	No data	n/a	MINIMUM
STATUS_BIT	n/a	No data	13	OFF
STATUS_WORD	n/a	No data	8	OFF
H_KEEP_AH	n/a	No data	8	OFF
MEAS_BRATE	n/a	No data	5	OFF
USER_RATE	n/a	No data	5	OFF
CLOCK_SIGNAL	n/a	No data	1	OFF
DATA_SIGNAL	n/a	No data	1	OFF
FRAME_SYNC	n/a	No data	1	OFF
STATUS_SYNC	n/a	No data	1	OFF
LEARNT	n/a	No data	n/a	MINIMUM
DATA_RATE	n/a	No data	1	OFF
TEST_PATTERN	n/a	No data	1	OFF
PRBS_LEN	n/a	No data	13	OFF
PRBS_SENSE	n/a	No data	1	OFF
WORD	n/a	No data	8	OFF
WORD_LEN	n/a	No data	13	OFF
RX_MODE	1	No data	1	OFF
RX_PCM	n/a	No data	n/a	MINIMUM
CONFIGURE	n/a	No data	n/a	MINIMUM
SYSTEM	1	No data	1	OFF
BANK	1	No data	1	OFF
ALBO	1	No data	1	OFF
MODE	1	No data	1	OFF
INPUT_MODE	1	No data	1	OFF
CLOCK_INPUT	1	No data	1	OFF
CLOCK_SOURCE	1	No data	1	OFF
BIT_RATE	12	No data	5	OFF
PATTERN	1	No data	1	OFF
PRBS_LEN	1	No data	1	OFF
PRBS_SENSE	1	No data	1	OFF
PRBS_LIMIT	1	No data	1	OFF
PRBS_OCTET	1	No data	1	OFF
DATA_CODE	1	No data	1	OFF
DATA_TIMED	1	No data	1	OFF
CHANNEL	13	No data	13	OFF
NX64	8	No data	8	OFF
LINE_CODE	1	No data	1	OFF
SPEAKER	1	No data	1	OFF
LINE	n/a	No data	n/a	MINIMUM
FREQ	n/a	No data	5	OFF

COMMAND MNEMONIC	<----------send data----------	---------->	<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
OFFSET	n/a	No data	2	OFF
IMPEDANCE	1	No data	1	OFF
LEVEL	n/a	No data	5	OFF
DB	n/a	No data	5	OFF
VREF	n/a	No data	5	OFF
SIGNAL	n/a	No data	n/a	MINIMUM
MODE	1	No data	1	OFF
CHANNEL	13	No data	13	OFF
PRESENT	n/a	No data	8	OFF
PREVIOUS	n/a	No data	8	OFF
DTMF_CHANNEL	13	No data	13	OFF
DIALLED_NO	n/a	No data	7	OFF
ERRORS	n/a	No data	7	OFF
IDLE_CODE	8	No data	8	OFF
ALL_CHANNELS	n/a	No data	(30)<13>	OFF
C_BITS	n/a	No data	11	OFF
NPD	n/a	No data	n/a	MINIMUM
MODE	1	No data	1	OFF
TIME	n/a	No data	5	OFF
BITS	n/a	No data	2	OFF
DEMUX	n/a	No data	n/a	MINIMUM
MODE	1	No data	1	OFF
FROM	1	No data	1	OFF
TO	1	No data	1	OFF
INPUT_MODE	1	No data	1	OFF
LINE_CODE	1	No data	1	OFF
CLOCK_INPUT	1	No data	1	OFF
TRIB_34M	13	No data	13	OFF
TRIB_8M	13	No data	13	OFF
TRIB_2M	13	No data	13	OFF
RX_SDATA	n/a	No data	n/a	MINIMUM
INTERFACE	1	No data	1	OFF
TERMINATION	1	No data	1	OFF
LINE_CODE	1	No data	1	OFF
STRUCTURE	1	No data	1	OFF
BIT_RATE	12	No data	5	OFF
TIMING	1	No data	1	OFF
TIM_SRC_POL	1	No data	1	OFF
TIM_OUTPUT	1	No data	1	OFF
TIM_OUT_POL	1	No data	1	OFF
DATA_RATE	1	No data	1	OFF
X50_CHANNEL	13	No data	13	OFF
X50_CH_PAIR	1	No data	1	OFF
X50__CH_MASK	8,8,8,8,8	No data	8,8,8,8,8	OFF
TEST_PATTERN	1	No data	1	OFF
PRBS_LEN	13	No data	13	OFF
PRBS_SENSE	1	No data	1	OFF
WORD	8	No data	8	OFF
WORD_LEN	13	No data	13	OFF
STATUS_MODE	1	No data	1	OFF
IN_THRESH	2	No data	2	OFF
OUT_THRESH	2	No data	2	OFF
PATTERN_MASK	8	No data	8	OFF
SDME_MASK	8	No data	8	OFF
SDME_MSUMM	n/a	No data	8	OFF
SDME_SUMMARY	n/a	No data	8	OFF
SDRX_MASK	8	No data	8	OFF
SDRX_MSUMM	n/a	No data	8	OFF

COMMAND MNEMONIC	<----------send data----------	--------->	<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
SDRX_SUMMARY	n/a	No data	8	OFF
SDTX_MASK	8	No data	8	OFF
SDTX_MSUMM	n/a	No data	8	OFF
SDTX_SUMMARY	n/a	No data	8	OFF
SD_MASK	8	No data	8	OFF
SD_MSUMM	n/a	No data	8	OFF
SD_SUMMARY	n/a	No data	8	OFF
SHIFT_PRINT	No data	n/a	n/a	OFF
SIG_DIGITS	13	No data	13	OFF
SOFT_VERSION	n/a	No data	7,7,7	OFF
START	No data	n/a	n/a	OFF
STOP	No data	n/a	n/a	OFF
STORE	n/a	6	n/a	MINIMUM
DELETE	6	n/a	n/a	OFF
RECALL	6	n/a	n/a	OFF
STORE	6,7	n/a	n/a	OFF
NAME	n/a	6	7	OFF
STATUS	n/a	6	1	OFF
FIXED_RECALL	1	n/a	n/a	OFF
FIXED_NAME	n/a	1	7	OFF
SWITCH	n/a	No data	n/a	MINIMUM
TYPE	n/a	No data	1	OFF
DATA_PORT	1	No data	1	OFF
PCM_PORT	1	No data	1	OFF
TEST	n/a	No data	n/a	MINIMUM
LIMITS	n/a	No data	n/a	MINIMUM
TYPE	1	No data	1	OFF
LOCAL	2	No data	2	OFF
MEDIUM	2	No data	2	OFF
HIGH	2	No data	2	OFF
MEDIUM_RADIO	2	No data	2	OFF
HIGH_RADIO	2	No data	2	OFF
CLASS1	2	No data	2	OFF
CLASS2	2	No data	2	OFF
CLASS3	2	No data	2	OFF
CLASS4	2	No data	2	OFF
CLASS1_RADIO	2	No data	2	OFF
CLASS2_RADIO	2	No data	2	OFF
CLASS3_RADIO	2	No data	2	OFF
CLASS4_RADIO	2	No data	2	OFF
DM_INTERVAL	2	No data	5	OFF
ES_INTERVAL	2	No data	5	OFF
SES_INTERVAL	2	No data	5	OFF
DM_OBJ	2	No data	5	OFF
ES_OBJ	2	No data	5	OFF
SES_OBJ	2	No data	5	OFF
DM_ALL	2	No data	5	OFF
ES_ALL	2	No data	5	OFF
SES_ALL	2	No data	5	OFF
LIMITS_G821	n/a	No data	n/a	MINIMUM
PER_ES	2	No data	5	OFF
PER_ES_EN	1	No data	1	OFF
PER_SES	2	No data	5	OFF
PER_SES_EN	1	No data	1	OFF
PER_DM	2	No data	5	OFF
PER_DM_EN	1	No data	1	OFF
PER_US	2	No data	5	OFF
PER_US_EN	1	No data	1	OFF

COMMAND MNEMONIC	<----------send data---------->		<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
LIMITS_G826	n/a	No data	n/a	MINIMUM
ES_RATIO	4	No data	4	OFF
ES_RATIO_EN	1	No data	1	OFF
SES_RATIO	4	No data	4	OFF
SES_RATIO_EN	1	No data	1	OFF
BBE_RATIO	4	No data	4	OFF
BBE_RATIO_EN	1	No data	1	OFF
PER_US	2	No data	5	OFF
PER_US_EN	1	No data	1	OFF
FWD_PATH	1	No data	1	OFF
LIMITS_M2100	n/a	No data	n/a	MINIMUM
ES_S1	2	No data	2	OFF
ES_S1_EN	1	No data	1	OFF
ES_S2	2	No data	2	OFF
ES_S2_EN	1	No data	1	OFF
SES_S1	2	No data	2	OFF
SES_S1_EN	1	No data	1	OFF
SES_S2	2	No data	2	OFF
SES_S2_EN	1	No data	1	OFF
US_S1	2	No data	2	OFF
US_S1_EN	1	No data	1	OFF
US_S2	2	No data	2	OFF
US_S2_EN	1	No data	1	OFF
FWD_PATH	1	No data	1	OFF
THRESHOLD	n/a	No data	n/a	MINIMUM
FR_ERRS	2	No data	2	OFF
CRC_BLOCKS	2	No data	2	OFF
RE1	2	No data	2	OFF
PARAMETERS	n/a	No data	n/a	MINIMUM
LENGTH	1	No data	1	OFF
TERM_AFTER	6,6,6	No data	6,6,6	OFF
BUZZER	1	No data	1	OFF
GATING	1	No data	1	OFF
ERROR_TYPE	1	No data	1	OFF
BURST_THRESH	1	No data	1	OFF
PROGRESS	n/a	No data	n/a	MINIMUM
START_TIME	n/a	No data	6,6,6,6,6,6	OFF
TERM_AFTER	n/a	No data	6,6,6	OFF
STOP_TIME	n/a	No data	6,6,6,6,6,6	OFF
MEAS_TIME	n/a	No data	6,6,6,6	OFF
POW_LOS_TIME	n/a	No data	6,6,6,6	OFF
SETUP	n/a	No data	n/a	MINIMUM
INTERVAL	1	No data	1	OFF
STORED_INT	2	No data	2	OFF
SD_LOOPBACK	n/a	No data	n/a	MINIMUM
CONFIGURE	n/a	No data	n/a	MINIMUM
LOOP_MODE	1	No data	1	OFF
DER_TRIB	7	No data	7	OFF
NUM_OF_WORDS	13	No data	13	OFF
LOOP_WORD	8	No data	8	OFF
CONTROL	1	n/a	n/a	OFF
LOOP_INFO	n/a	No data	n/a	MINIMUM
STATUS	n/a	No data	1	OFF
TRIB_INDEX	n/a	No data	13	OFF
ID_NUMBER	n/a	13	13	OFF
THRESHOLD	4	No data	4	OFF
TIME	6,6,6	No data	6,6,6	OFF
TXRX_MASK	8	No data	8	OFF

COMMAND MNEMONIC	<----------send data--------->		<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
TXRX_MSUMM	n/a	No data	8	OFF
TXRX_SUMMARY	n/a	No data	8	OFF
TX_DATA	n/a	No data	n/a	MINIMUM
CONFIGURE	n/a	No data	n/a	MINIMUM
SYSTEM	1	No data	1	OFF
MODE	1	No data	1	OFF
LINE_CODE	1	No data	1	OFF
BIT_RATE	12	No data	5	OFF
PATTERN	1	No data	1	OFF
PRBS_LEN	1	No data	1	OFF
PRBS_SENSE	1	No data	1	OFF
WORD	8	No data	8	OFF
CLOCK_SOURCE	1	No data	1	OFF
CLOCK_SENSE	1	No data	1	OFF
TIMING_OUT	1	No data	1	OFF
ASYNC	n/a	No data	n/a	MINIMUM
BIT_RATE	1	No data	1	OFF
CHAR_RATE	1	No data	1	OFF
DATA_BITS	1	No data	1	OFF
PARITY	1	No data	1	OFF
STOP_BITS	1	No data	1	OFF
USER_MSG	(1-19)<10>	No data	(1-19)<10>	OFF
CTRL_LINES	11	No data	11	OFF
CTRL_DELAY	1	No data	1	OFF
TX_DIAL	No data	n/a	n/a	OFF
TX_ERROR	n/a	No data	n/a	MINIMUM
STATUS	1	No data	1	OFF
MODE	1	No data	1	OFF
TARGET	1	No data	1	OFF
TYPE	1	No data	1	OFF
LENGTH	1	No data	1	OFF
BURST_SIZE	1	No data	1	OFF
BURST_RATE	4	No data	4	OFF
RATE	4	No data	4	OFF
CRC_BLK_TYPE	1	No data	1	OFF
CRC_BLK_ERR	2	No data	2	OFF
CRC_BLK_SIZE	1	No data	1	OFF
TX_INFO	n/a	No data	n/a	MINIMUM
DATA	n/a	No data	n/a	MINIMUM
STATUS	n/a	No data	1	OFF
CLOCK	n/a	No data	1	OFF
PCM	n/a	No data	n/a	MINIMUM
STATUS	n/a	No data	1	OFF
CLOCK	n/a	No data	1	OFF
SDATA	n/a	No data	n/a	MINIMUM
USER_RATE	n/a	No data	5	OFF
CLOCK_SIGNAL	n/a	No data	1	OFF
DATA_SIGNAL	n/a	No data	1	OFF
FRAME_SYNC	n/a	No data	1	OFF
TX_MODE	1	No data	1	OFF
TX_OFF	No data	n/a	n/a	OFF
TX_ON	No data	n/a	n/a	OFF
TX_PCM	n/a	No data	n/a	MINIMUM
CONFIGURE	n/a	No data	n/a	MINIMUM
AIS	1	No data	1	OFF
SYSTEM	1	No data	1	OFF
BANK	1	No data	1	OFF
MODE	1	No data	1	OFF

COMMAND MNEMONIC	**<----------send data---------** **<-non query->**	**><---query--->**	**><--return data-->**	**<-header->** **<-default->**
BIT_RATE	12	No data	5	OFF
PATTERN	1	No data	1	OFF
PRBS_LEN	1	No data	1	OFF
PRBS_SENSE	1	No data	1	OFF
PRBS_LIMIT	1	No data	1	OFF
PRBS_OCTET	1	No data	1	OFF
WORD	8	No data	8	OFF
DATA_CODE	1	No data	1	OFF
DATA_TIMED	1	No data	1	OFF
CHANNEL	13	No data	13	OFF
NX64	8	No data	8	OFF
FILL_PATN	1	No data	1	OFF
FILL_WORD	8	No data	8	OFF
CLOCK_SOURCE	1	No data	1	OFF
CLOCK_MODE	1	No data	1	OFF
CLOCK_OUTPUT	1	No data	1	OFF
LINE_CODE	1	No data	1	OFF
CLOCK_RATE	2	No data	2	OFF
CLOCK_OFFSET	6	No data	6	OFF
AIS_ZEROS	1	No data	1	OFF
AIS_RATE	4	No data	4	OFF
LEVEL	1	No data	1	OFF
LOOPBACK	n/a	No data	n/a	MINIMUM
MAKE_A_LEN	13	No data	13	OFF
MAKE_A_PATN	8	No data	8	OFF
BREAK_A_LEN	13	No data	13	OFF
BREAK_A_PATN	8	No data	8	OFF
MAKE_B_LEN	13	No data	13	OFF
MAKE_B_PATN	8	No data	8	OFF
BREAK_B_LEN	13	No data	13	OFF
BREAK_B_PATN	8	No data	8	OFF
MODE	1	No data	1	OFF
SEQUENCE	n/a	No data	n/a	MINIMUM
FRAME_NO	1	No data	1	OFF
MF_NO	1	No data	1	OFF
YELLOW	1	No data	1	OFF
FRAME_ALARM	1	No data	1	OFF
MF_ALARM	1	No data	1	OFF
AIS_64_ALARM	1	No data	1	OFF
TS16_ALARM	1	No data	1	OFF
SIGNAL	n/a	No data	n/a	MINIMUM
MODE	1	No data	1	OFF
CHANNEL	13	No data	13	OFF
SIG_CODE	8	No data	8	OFF
OTHER_CODE	8	No data	8	OFF
DTMF_CHANNEL	13	No data	13	OFF
DTMF_MODE	1	No data	1	OFF
TONE_ON	2	No data	2	OFF
TONE_OFF	2	No data	2	OFF
PAUSE_DURAT	2	No data	2	OFF
NEW_NUMBER	7	No data	7	OFF
C_BITS	11	No data	11	OFF
MUX	n/a	No data	n/a	MINIMUM
MODE	1	No data	1	OFF
FROM	1	No data	1	OFF
TO	1	No data	1	OFF
CLOCK_SOURCE	1	No data	1	OFF
CLOCK_OFFSET	6	No data	6	OFF

COMMAND MNEMONIC	<----------send data---------> <-non query->	 <---query--->	<--return data-->	<-header-> <-default->
CLOCK_OUTPUT	1	No data	1	OFF
LINE_CODE	1	No data	1	OFF
TRIB_34M	13	No data	13	OFF
FILL_PAT_34M	1	No data	1	OFF
TRIB_8M	13	No data	13	OFF
FILL_PAT_8M	1	No data	1	OFF
TRIB_2M	13	No data	13	OFF
FILL_PAT_2M	1	No data	1	OFF
MUX_SEQUENCE	n/a	No data	n/a	MINIMUM
NO_140M	1	No data	1	OFF
ALARM_140M	1	No data	1	OFF
NO_34M	1	No data	1	OFF
ALARM_34M	1	No data	1	OFF
NO_8M	1	No data	1	OFF
ALARM_8M	1	No data	1	OFF
MUX_OVERHEAD	11	No data	11	OFF
OVERHEAD	11,11	No data	11,11	OFF
TX_SDATA	n/a	No data	n/a	MINIMUM
INTERFACE	1	No data	1	OFF
LINE_CODE	1	No data	1	OFF
STRUCTURE	1	No data	1	OFF
BIT_RATE	12	No data	12	OFF
DROP_INSERT	1	No data	1	OFF
DI_INTERFACE	1	No data	1	OFF
DI_LINE_CODE	1	No data	1	OFF
CLOCK_SRC	1	No data	1	OFF
CLOCK_SRC_POL	1	No data	1	OFF
ALIGN_LOCK	1	No data	1	OFF
CLOCK_OUTPUT	1	No data	1	OFF
CLK_OUT_POL	1	No data	1	OFF
DATA_RATE	1	No data	1	OFF
X50_CHANNEL	13	No data	13	OFF
X50_CH_PAIR	1	No data	1	OFF
X50_CH_MASK	8,8,8,8,8	No data	8,8,8,8,8	OFF
TEST_PATTERN	1	No data	1	OFF
PRBS_LEN	13	No data	13	OFF
PRBS_SENSE	1	No data	1	OFF
WORD	8	No data	8	OFF
WORD_LEN	13	No data	13	OFF
X50_FILL_PAT	1	No data	1	OFF
X50_FILL_ST	1	No data	1	OFF
STATUS_MODE	1	No data	1	OFF
STATUS_CODE	1	No data	1	OFF
STATUS_BIT	13	No data	13	OFF
STATUS_WORD	8	No data	8	OFF
DIST_BIT	8	No data	8	OFF
H_KEEP_BH	8	No data	8	OFF
ERR_INJECT	1	No data	1	OFF
ERR_RATE	1	No data	1	OFF
ERR_TARGET	1	No data	1	OFF
ERR_BIT	13	No data	13	OFF
AIS_LENGTH	2	No data	2	OFF
AIS_MODE	1	No data	1	OFF
IN_THRESH	2	No data	2	OFF
OUT_THRESH	2	No data	2	OFF
PATTERN_MASK	8	No data	8	OFF
UPDATE_INT	1	No data	1	OFF
USER_OPTIONS	n/a	No data	n/a	MINIMUM

COMMAND MNEMONIC	<----------send data---------->		<--return data-->	<-header->
	<-non query->	<---query--->		<-default->
CURSOR_SKIP	1	No data	1	OFF
LANGUAGE	1	No data	1	OFF
VOICE_ENCODE	1	No data	1	OFF
LED_ERR_THR	4	No data	4	OFF
EXCESS_ZEROS	1	No data	1	OFF
VOLUME	13	n/a	n/a	OFF
*CLS	No data	n/a	n/a	OFF
*ESE	8	No data	8	OFF
*ESR	n/a	No data	8	OFF
*IDN	n/a	No data	3,3,6,3	OFF
*LRN	n/a	No data	No data	OFF
*OPC	No data	No data	6	OFF
*OPT	n/a	No data	9,9,9,6	OFF
*PSC	13	No data	13	OFF
*RST	No data	n/a	n/a	OFF
*SRE	8	No data	8	OFF
*STB	n/a	No data	8	OFF
*TRG	No data	n/a	n/a	OFF
*TST	n/a	No data	6	OFF
*WAI	No data	n/a	n/a	OFF

Chapter 5
BRIEF TECHNICAL DESCRIPTION

Contents

List of figures

Introduction

This chapter is a brief technical description of 2851 Digital Communications Analyzer and should be read in conjunction with block diagrams Fig. 5-1 to 5-6. A detailed description is given in the Maintenance section of the Service Manual.

Reference to 2851 includes all versions unless stated otherwise.

Power supplies

Mains voltages (210 V to 240 V or 105 V to 120 V AC) are transformed and rectified and presented to a pulse width modulated step-down regulator circuit which outputs regulated +5 V, +10 V and −10 V supply lines.

For 2854S and 2855S a further output is taken from the regulator circuit and used to provide a −5.2 V supply line. In order to conserve power, unused sections of circuitry in 2854S and 2855S are powered down when they are not required e.g. 140 Mbit/s circuit when only 34 Mbit/s operation is required.

A number of external DC supply options are available allowing operation in range 10 V to 72 V DC. These are converted to a voltage suitable for use by the regulator above.

A further option allows for a battery pack to be added (permanently) which is charged from the mains supply and may be used to power the instrument when mains power is unavailable or is interrupted.

Signal processing/routing
(see fig. 5-1)

Introduction

The signal processing/routing allows flexibility of clocking arrangements, receiver capability and independent transmitter capability. Circuit blocks are present to deal with all aspects of signal generation and reception including:

PCM framed or unframed and associated bit error rate tests.
Insertion and extraction of audio signals in PCM signals.
Insertion and extraction of data in one or n channels.
Signalling, both pulse and DTMF.
Comparison of clock rate with second receive PCM signal.
Data interfaces via fixed (RS-232, G.703) or interface cable configurable (X.21, RS-449, V.35) connectors.

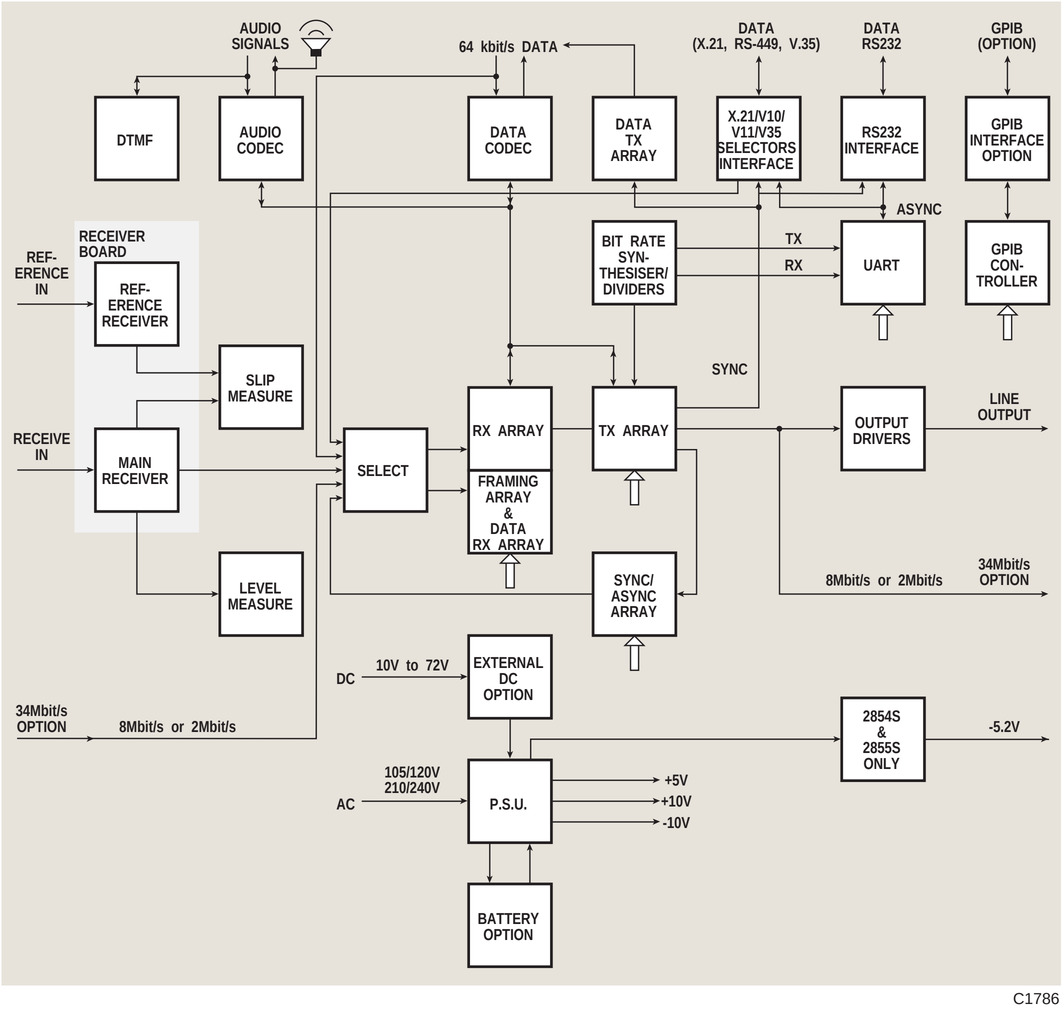


Fig. 5-1 Signal processing 2851 - block diagram

Receiver section

The main receiver, reference receiver and first section of level measurement are contained on a plug-in receiver board allowing different boards to address different bit rate combinations.

Main receiver :

Signals from the PCM line are presented to this circuit which is set to match the line voltage, impedance and, if necessary, cable equalization. The clock and data are extracted from the signal and passed on to the receiver array via the selector circuit.

Level measure :

The peak level of the applied main input signal is converted to a frequency. This frequency is measured and ultimately available as a level measurement in volts.

Reference receiver :

Signals from a second PCM line are presented to this circuit which extracts the clock signal and passes it to a counter.

Slip measurement :

The clock frequencies of the main and reference inputs are compared to give a measure of their movement relative to each other.

Bit rate synthesizer/dividers

A phase locked loop frequency synthesizer circuit generates an internal bit rate clock signal for use by the Tx and Rx array devices.

A phase locked loop control device uses a 10 MHz crystal oscillator reference frequency to control the frequency stability of a VCO frequency synthesizer. Depending on the bit rate required, the VCO output is divided to provide the bit rate frequency required. The VCO frequency, divider control and reference frequency correction are controlled by the secondary processor.

For asynchronous data rates, independent dividers are available for transmit and receive operation.

Receiver and framing array block

The receive array decodes the incoming signal and extracts such items as line codes errors, framing errors, bit errors in patterns, CRC information, signalling bits, alarms and other bits as relevant to the system in use.

Alignment to the frame structure is controlled by a separate configurable array.

Information extracted from individual channels is presented to a bus, in bursts, for use by the data and audio codecs.

Transmitter array

The transmitter array generates the required system bit stream from internal sources or from the external data/audio codecs to provide the information in PCM signal channels. This information can be signalling, framing, CRC or data scrambling can be provided as well as generation of standard bit patterns. Errors can then be injected into specified bits or all bits. Independent line encoded and TTL NRZ outputs are available.

Line output stage

This stage converts the array signals to unbalanced and balanced signals of the correct level and impedance suitable for presentation to the user.

Audio codec block and DTMF

Audio signals presented to the instrument are converted to a digital stream for use by the transmit array for inclusion in a specified channel.

Similarly, channels extracted by the receiver array are fed to the audio codec to be converted to audio signals. Additionally the audio signal can be monitored via the internal loudspeaker.

A DTMF (Dual Tone Multi Frequency) circuit is available and DTMF signals can be superimposed on incoming (unconnected) audio channels for encoding into PCM signals. They can also be decoded and superimposed on outgoing audio channels extracted from PCM signals.

Data codec block

64 kbit/s channels extracted by the receiver array are routed (in bursts) to the data codec, converted to codirectional, contradirectional or NRZ and buffered for external use.

Similarly, codirectional, contradirectional or NRZ 64 kbit/s data can be input, converted and accepted into the transmitter array for inclusion as a channel in the PCM signal.

A second block (Data Tx Array) is used for generation of 64 kbit/s codirectional or contradirectional data using a bit stream from the transmitter array. Received 64 kbit/s data is routed directly to the framing and receiver array block.

RS-232 interface, UART and sync/async array

For asynchronous operation (RS-232 and RS-449) a UART block encodes and decodes information to and from the line (via interface ICs) under software control. Data is either software generated and received (messages) or array generated and received (patterns) via the sync/async array.

X.21, RS-449, V.35 selectors/interface

Internally generated NRZ signals are converted by the appropriate circuit and presented to a multiway connector. Received signals on the same connector are converted to NRZ signals. When the appropriate interface adaptor cable is plugged in, the correct signals are routed to the correct socket pin for connection to customer equipment.

Signal routing

Internal signal routing is complex and not shown on Fig. 5-1. All internal links are NRZ data and clock. An example of signal selection is shown at the input to the receiver and framing block where the signal can be from the main receiver, from 64 kbit/s data direct, from any of the data interfaces or from the sync/async array as required.

2852(S) / 2853(S) 34 Mbit/s, MUX/DEMUX - Option 14

Introduction

The signal processing/routing capability of the 34 Mbit/s board allows flexibility of clocking arrangements, receiver operation and mux/demux configuration. The circuitry allows:

Reception and transmission of 34 Mbit Framed or Unframed PCM data and associated bit error rate tests.

Mux and demux of a 2 or 8 Mbit stream to and from a 34 Mbit/s Framed signal.

Mux and demux of a 2 Mbit stream to and from an 8 Mbit/s Framed signal.

Receiver section

The 34 Mbit/s receiver is contained in the analogue area of the 34 Mbit/s board. Its main function is to extract clock and data from the PCM input signal and present them to the digital circuitry.

Main receiver:

Signals from the PCM line are presented to this circuit. The receiver can operate in 3 modes; Terminated mode which can receive signals with up to 12 dB cable loss, Monitor mode when the received signal is amplified by a selected gain and Bridging mode when the receiver presents a high impedance to the PCM line.

Level measure:

The peak level of the applied main input signal is converted to a voltage. This is then passed to an A/D converter.

Input frequency:

The frequency of the extracted clock is measured with reference to the TCXO on the signal processing board.

Bit rate clock

The 34 Mbit/s bit rate is set by a VCXO, driven from a D/A converter. The transmit rate is referenced against the instrument TCXO and is continuously updated. Alternatively an external clock may be used.

Line output stage

This stage converts the CMOS signals from the digital section to unbalanced signals of the correct level and impedance when correctly terminated in 75 ohms.

Digital section

The main components of the digital section are 3 FPGAs and two asics. The asics perform the mux/demux function. The FPGA arrays have different configurations depending on whether the instrument is operating in 34 Mbit/s Framed or Unframed mode.

Framed mode (see fig. 5-2)

One asic performs the mux/demux between 34 Mbit/s and 8 Mbit/s while the other performs the mux/demux between 8 Mbit/s and 2 Mbit/s. In this mode the FPGAs are configured to measure code errors, frame errors and to provide tributary selection.

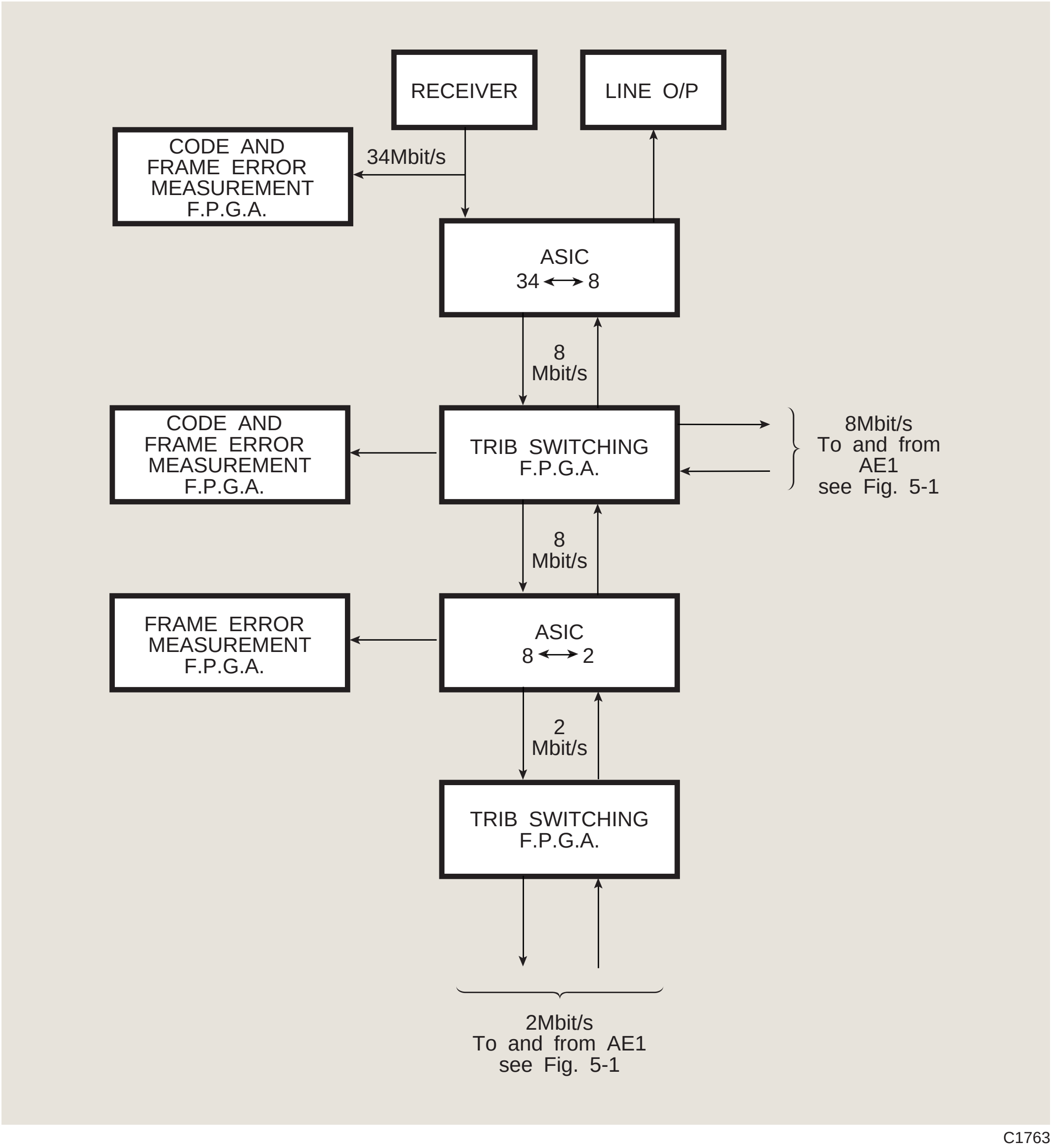


Fig. 5-2   Signal processing 34 Mbit/s Framed mode, 2852(S)/2853(S) - block diagram

Unframed mode
(see fig. 5-3)

The asics are not used in this mode of operation. The 3 FPGAs are configured to provide pattern generation, pattern detection, HDB3 encoder/decoder functions and the associated error rate tests.

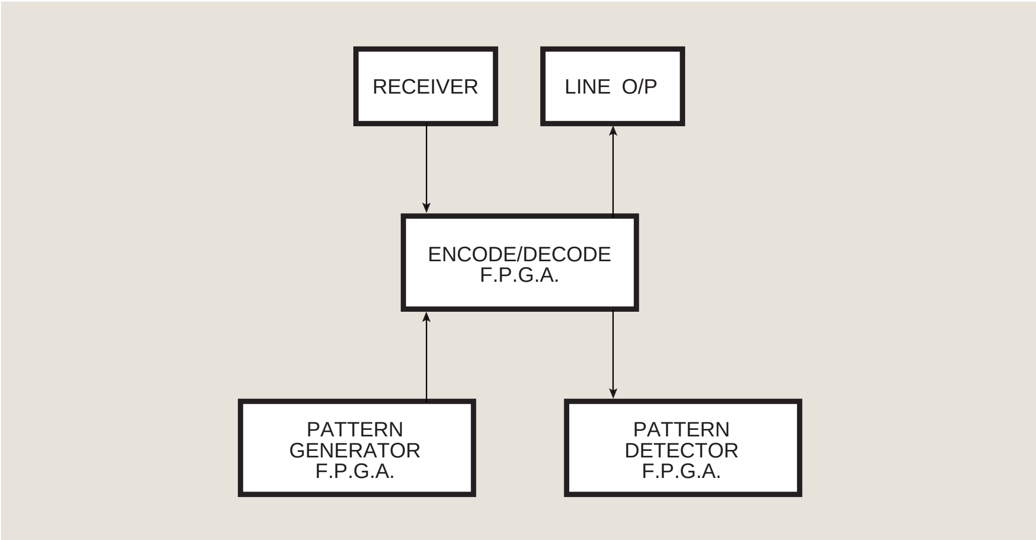


Fig. 5-3   Signal processing 34 Mbit/s Unframed mode, 2852(S)/2853(S) - block diagram

2854S/2855S 34 Mbit/s & 140 M/bits MUX/DEMUX
(see fig. 5-4)

Introduction

The signal processing/routing capability of the 140 Mbit/s board allows flexibility of clocking arrangements, receiver operation and mux/demux configuration. The circuitry allows:

Reception and transmission of 140 Mbit framed or unframed PCM data and associated bit error rate tests.

Reception and transmission of 34 Mbit framed or unframed PCM data and associated bit error rate tests.

Mux and demux of a 2 or 8 or 34 Mbit/s stream to and from a 140 Mbit/s framed signal.

Mux and demux of a 2 or 8 Mbit/s stream to and from a 34 Mbit/s framed signal.

Mux and demux of a 2 Mbit/s stream to and from a 8 Mbit/s framed signal.

Receiver section

The 140 or 34 Mbit/s input signal is routed to the appropriate receiver. The signal is equalised, its level measured and its clock recovered.

Demux blocks

Each block frame aligns to the incoming signal, measures the frequency, counts error parameters as relevant and passes the selected demuxed trib to the next lower block.

Mux blocks

Each block combines the next lower level signal with fill patterns and framing information and passes the composite signal up to the next higher block or to the output circuits.

Each block contains its own frequency source.

Output section

A common output stage converts the digital signals of the correct level and impedance for connection to external equipment.

Unframed mode

In this mode unused blocks are used as pattern generators or error counters as necessary.

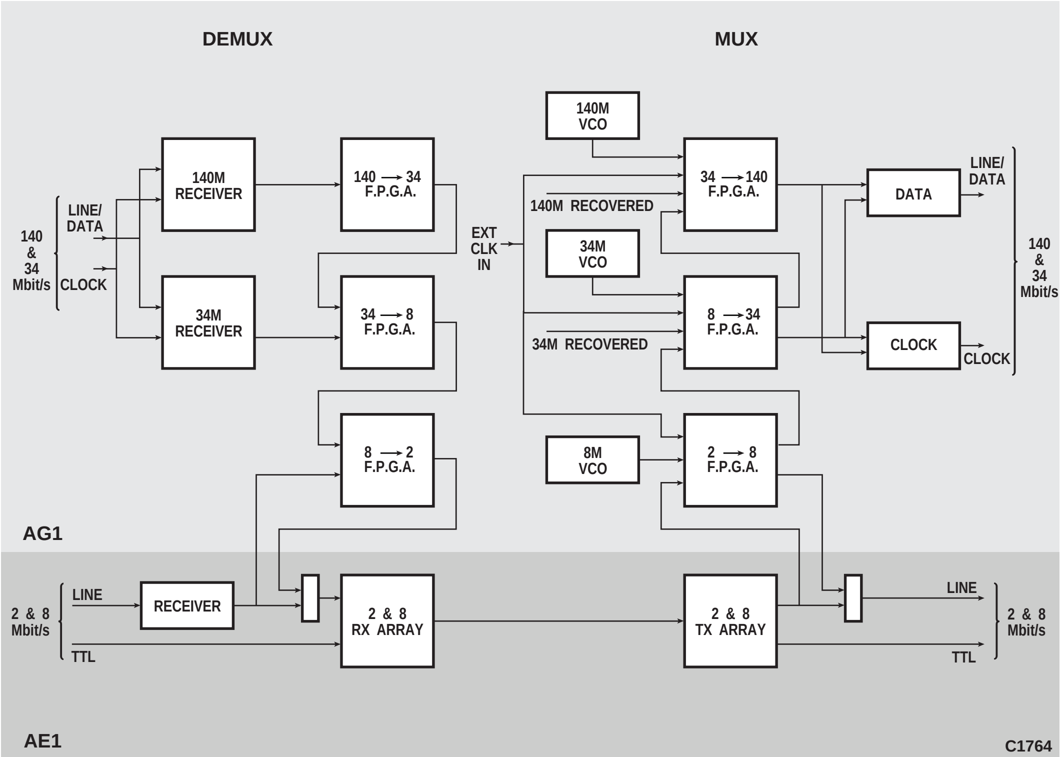


Fig. 5-4 Signal processing 34 Mbit/s & 140 Mbit/s, 2854S/2855S - block diagram

Structured Data X.50 (Option 24)
(See fig. 5-5)

Introduction

The structured data board generates and receives 64 kbit/s X.50 framed signals one channel being the test channel for Bit Error Rate tests. The signals are fed either direct via dedicated interfaces or indirect via 64 kbit/s PCM channels. The transmitter and the receiver are independent.

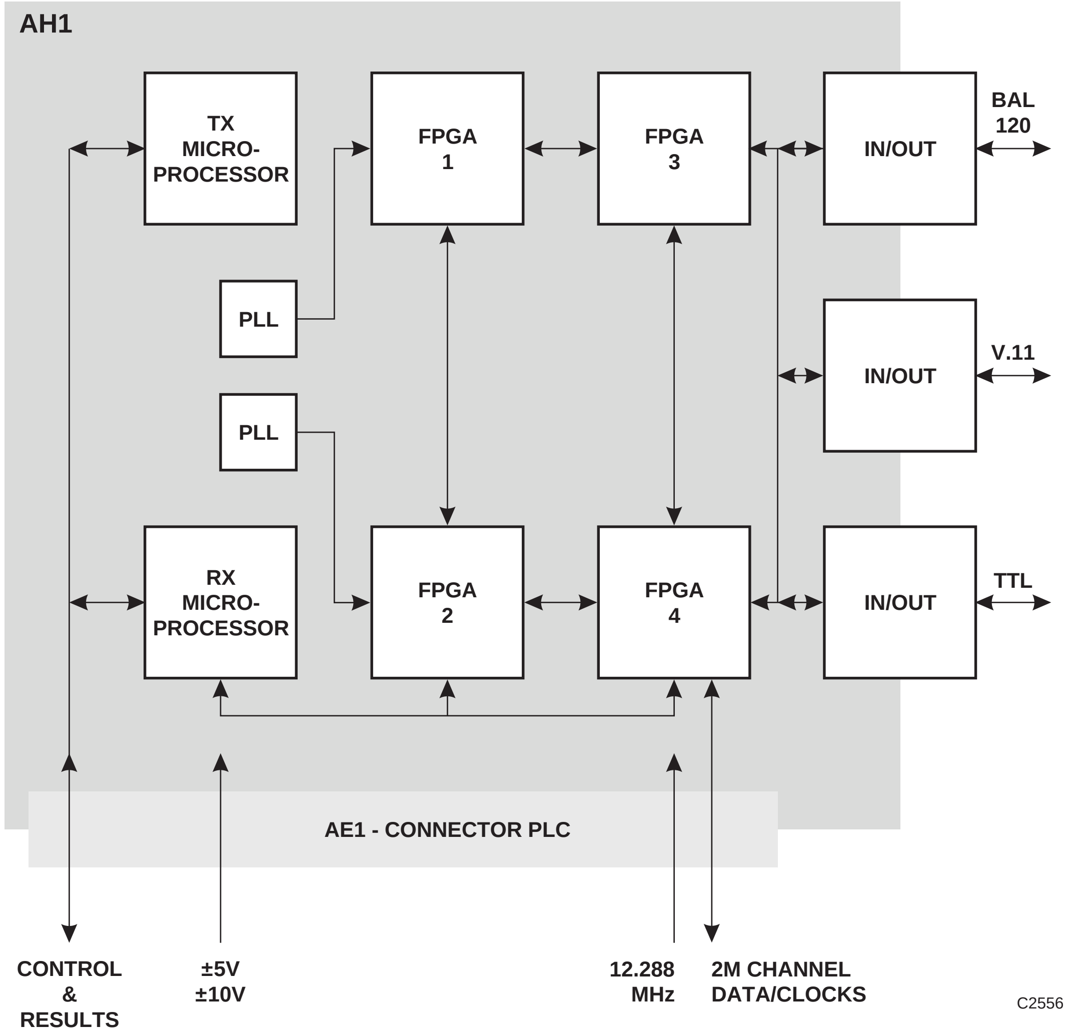


Fig. 5-5 Signal processing X.50 Structured Data (Option 24)

Microprocessors and FPGAs

The microprocessor section is used to load the FPGA designs, configure the FPGA to the correct mode of operation, read and write the correct format of data and interface to the primary and secondary microprocessors on AA2.

The transmit microprocessor generates part of the actual X.50 sequence and combines it with FPGA generated patterns. The resultant bytes are passed back to the FPGA for buffering and output.

Conversely the receiver microprocessor receives and analyses the buffered bit stream from the FPGA.

FPGA 1 & 2 provide pattern generation, error & frequency counter and local bus controller functions.

FPGA 3 & 4 provide signal detection, line encode/decode, clock retiming and selector functions.

Phase lock loops

The independent phase lock loops, by frequency comparison with the 12.288 MHz reference clock from the FPGA, provide outputs which can be used as transmitter clocks, receiver timed extraction circuits and demultiplex to sub-rate outputs.

Interfaces

Input and output signals are via dedicated 120 Ω Balanced V.1 and TTL interfaces each with a selection of clock sources.

Microprocessor control
(see fig. 5-6)

Microprocessors

The 2851 has a primary and a secondary microprocessor which communicate via a dual port RAM.

The primary processor (an MC68302 device) is concerned with the control of the instrument by the user and the presentation of data to the user. This can be local via the keyboard and LCD or remotely via the RS-232 or optional (2851S only) GPIB interface.

The secondary processor (an HD64180 device) is concerned with the low level control of the measurement hardware and acquisition and pre-processing of raw data (every second) for the primary processor to finish analyzing and deal with on a long term basis.

Both microprocessors are high integration devices incorporating such peripherals as clock generators, Uarts, DMA control, interrupt controllers, memory management etc.

Keyboard and LCD modules

The primary processor sequentially scans the 7 keyboard columns and reads the 7 keyboard rows to detect a key press. The LCD module has an on-board controller which provides a low level hardware interface for the display of text and graphics on the LCD.

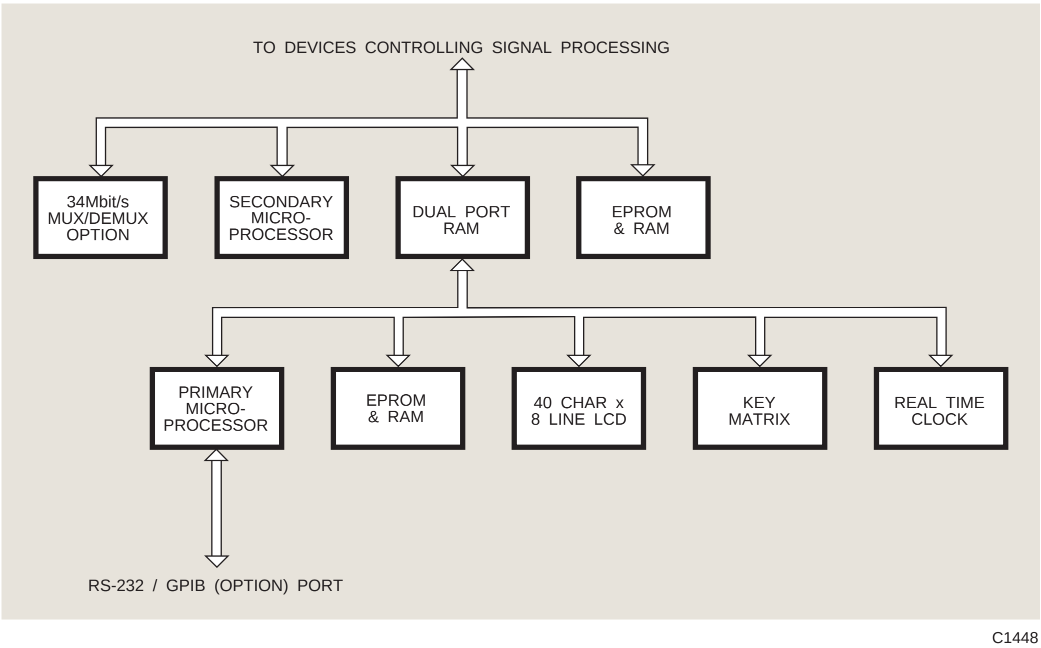


Fig. 5-6 Basic block diagram of 2851 microprocessor control

Chapter 6
ACCEPTANCE TESTING

Contents

List of figures

Recommended test equipment

Test equipment

Description	Minimum specification	Example
Digital Communications Analyzer	Transmitter and Receiver to be compatible with the unit under test.	IFR† 2851
*Digital Communications Analyzer	34 M bit/s transmit and receive capability	2852(S), 2853(S), 2854S or 2855S
**Digital Communications Analyzer	140 M bit/s transmit and receive capability	2854S or 2855S
***Digital Communications Analyzer	Transmit and receive Co-, Contra-directional and NRZ signals at 64 kbit/s	IFR† 2851 with option 24 or IFR† 2871
Cable Simulator	Up to 30 dB of attenuation to 3 MHz	W+G PKN-1
Oscilloscope	Cursor accuracy <1%	TEK 2245
AF Oscillator	600Ω Balanced output 0 dBm at 1 kHz	Rhode & Schwarz APN02

†IFR Ltd was previously known as Marconi Instruments Ltd

* For use when testing 34 Mbit/s systems (2852(S) or 2853(S)).

** For use when testing 140 Mbit/s systems (2854S or 2855S).

*** For use when testing the X.50 structured data systems (2850B(S) or 2851(S)).

Introduction

These Acceptance tests have been written to give a high level of confidence that the 2851 is operating correctly. Due to the great number of facilities that are available in the 2851 it is impractical to test all of them. These tests have been structured to test all the main external interfaces and functions.

The tests start with full details of settings and tests on 2048 kbit/s systems. These are used as the basis for tests on all the other systems.

All the tests are written on the basis that both the unit under test (UUT) and the test equipment 2851 has had the DEFAULT conditions recalled.

Allow 5 seconds for the instruments to synchronize before measuring bit rates, viewing patterns or checking alarms.

Reference to the UUT includes all 2851 versions and reference to test equipment 2851 implies the use of any one of the versions except where stated otherwise.

2048 kbit/s systems Option 01, 06, 07

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 2048 kbit/s ±50 ppm

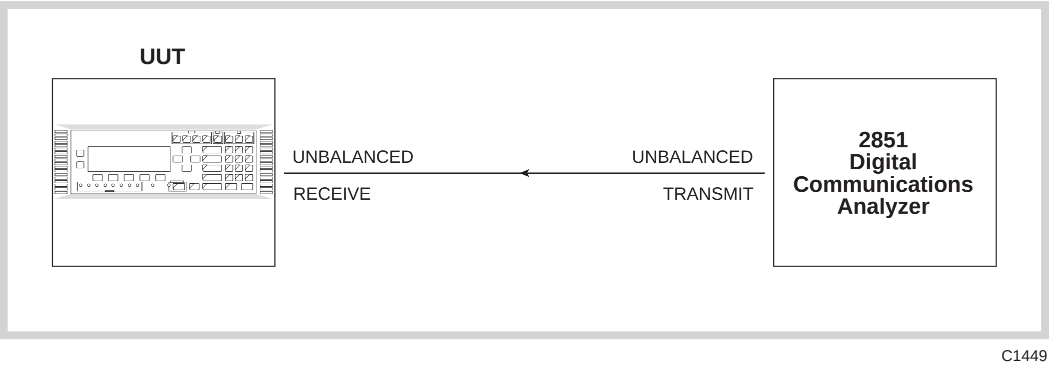


Fig. 6-1   Receiver tests set-up

a) Connect the test equipment as shown in Fig. 6-1.

b) Set the UUT as follows :-

RECALL Default

RX-SYSTEM Input Mode Terminated

c) On the test equipment 2851 select :-

RECALL Default

d) On the UUT 2851 select :-

RX-SYSTEM. Ensure that the displayed bit rate is within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 2 048.041	Min 2 047.959	Max 20	Min -20

e) On the test equipment 2851 set :-

TX-SUMMARY,CLOCK

..Rate :2048 kbit/s ..Offset 50 ppm

Ensure that the receiver re-locks to the input signal and no alarms occur on the UUT 2851.

f) Repeat (e) with a Transmit bit rate offset of -50 ppm.

1.2 Test patterns

a) Connect the test equipment as shown in Fig 6-1.

b) Set the UUT as follows :-

RECALL	Default	
RX-SYSTEM	System	2M/noMF
	Input Mode	Terminated
RX-TEST PATTERN	Sync to	Repetitive Word

c) Set the test equipment 2851 as follows :-

RECALL	Default	
TX-SUMMARY	TX	Off
	System	2M/noMF
	TX	On
TX-PATTERN	Carrying	All 0

d) On the UUT 2851 select :-

RX-TEST PATTERN

Ensure that there are no receive alarms on the UUT 2851 and that the "carrying" data is 00000000 00000000.

e) On the test equipment 2851 select :-

TX-PATTERN	Carrying	All 1

Repeat the procedure in (d), ensure that there are no receiver alarms and that the "carrying" data is 11111111 11111111.

1.3 Error measurement

a) Connect the test equipment as shown in Fig. 6-1.

b) Set the UUT as follows :-

RECALL	Default	
RX-SYSTEM	System	2M/CRC
	Input Mode	Terminated
	Buzzer	Every Error

c) Set the test equipment 2851 as follows :-

RECALL	Default	
TX-SUMMARY	TX	Off
	System	2M/CRC
	TX	On
TX-ERROR INJECTION	Injection	Enabled
	Mode	Manual
	1st Target Bit	Pattern
	Inject..	Bit Errors before CRC
	..	Singly

d) On the UUT 2851 select :-

	TEST	Start

Wait 5 seconds.

e) On the test equipment 2851 select TX INJECT, this will manually inject an error.

f) On the UUT 2851 select RESULT - OTHER ERRORS.

Each time the error inject key is pressed, the pattern bit errors should increase by 1 and the buzzer should sound on the UUT 2851.

TEST	Stop

1.4 Input sensitivity

Specification	
The input sensitivity is as follows :-	
Normal Mode (options 01,02,03 and 04):	The instrument will lock to an input signal of 3 V +2 dB to -6 dB.
ALBO (Options 01, 02, and 03):	There is an ALBO circuit which can be switched in or out. With the ALBO in the instrument will lock to an input signal of 3 V -3 dB to 3 V -30 dB.

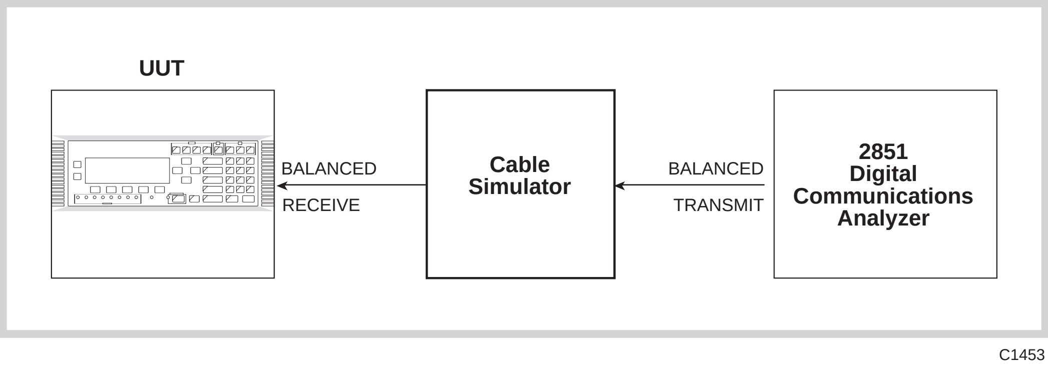


Fig. 6-2 Input sensitivity test set-up

1.4.1 Non ALBO input

a) Connect the test equipment as shown in Fig. 6-2.

b) Set the UUT 2851 as follows :-

RECALL	Default	
RX-SYSTEM	ALBO	Out
	Input Mode	Terminated
	Test Mode	Unframed
RX-TEST PATTERN	Sync to	Repetitive Word

c) Set the test equipment 2851 as follows :-

RECALL	Default	
TX-SUMMARY	TX	Off
	Test Mode	Unframed
	TX	On
TX-PATTERN	Carrying	Alternating

d) Ensure that the UUT locks to the test equipment 2851 without any alarms. Introduce 6 dB of cable simulator attenuation, making sure that the UUT remains locked.

e) Connect the 75 Ω unbalanced output of the test equipment 2851 via the cable simulator to the input of the UUT. Repeat (d) above for the unbalanced input.

1.4.2 ALBO input

a) Repeat (a) and (c) above but on the UUT 2851 select :-

RX-SYSTEM	ALBO	In

b) Ensure that the UUT locks to the test equipment 2851 without any alarms. Introduce 30 dB of cable simulation attenuation, making sure that the UUT remains locked.

c) Connect the 75 Ω unbalanced output of the test equipment 2851 via the cable simulator to the input of the UUT. Repeat (b) above tests for the unbalanced input.

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±10 ppm from 0°C to 55°C ±3 ppm aging rate per year.

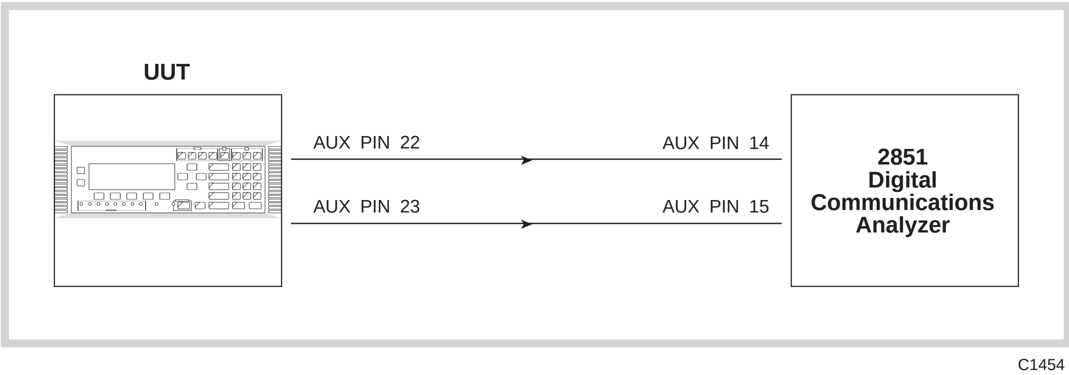


Fig. 6-3 Transmit bit rate test set-up

a) Connect the test equipment as shown in Fig. 6-3.

b) Set the UUT as follows :-

RECALL	Default	
TX-SUMMARY	Test Mode	Unframed

c) Set the test equipment 2851 as follows :-

RECALL	Default	
RX-SYSTEM	Input Mode Test Mode	NRZ Unframed

d) On the test equipment 2851.

Select the RX-SYSTEM display and ensure that the displayed bit rate is within the following limits.

Bit rate (kbit/s)		Offset (ppm)	
Max 2 048.041	Min 2 047.959	Max 20	Min -20

e) On the UUT 2851 select :-

TX-CLOCK	..Rate	2 144 kbit/s

f) On the test equipment 2851.

Select the RX-SYSTEM display and ensure that the displayed bit rate is within the following limits.

Bit rate (kbit/s)	
Max	Min
2 144.043	2 143.957

g) Repeat the procedure detailed in "e)" for a bit rate of 1952 kbit/s. Ensure that the received bit rate is within the following limits :-

Bit rate (kbit/s)	
Max	Min
1 952.039	1 951.961

2.2 Test patterns

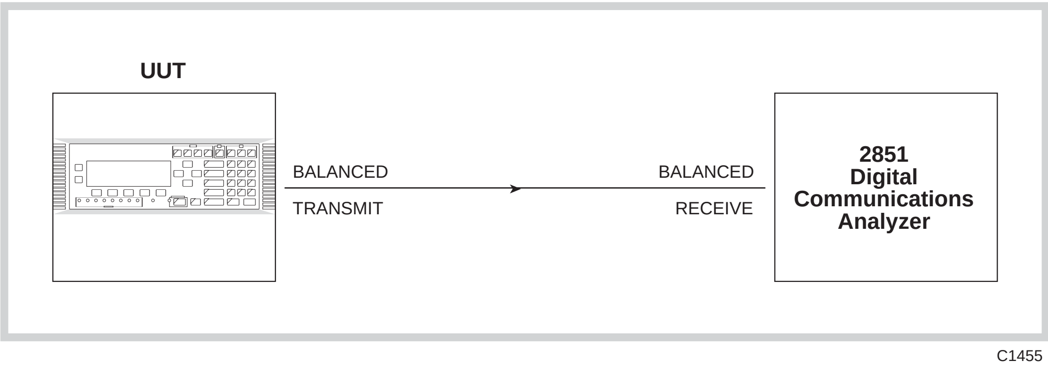


Fig. 6-4 Transmit test pattern test set-up

a) Connect the test equipment as shown in Fig. 6-4.

b) Set the UUT transmitter as follows :-

RECALL	Default	
TX-SUMMARY	TX	Off
	Test Mode	Framed Single Channel
	Channel	5
	Carrying	All 1
	TX	On
TX-PATTERN	Fill Pattern	8 Bit Word ...01010101

c) Set the test equipment 2851 as follows :-

RECALL	Default	
RX-SYSTEM	Input Mode	Terminated
	Test Mode	Single Framed Channel
	..Channel	5
RX-PATTERN	Sync to ..	Repetitive word

d) On the test equipment 2851 ensure that there are no receiver alarms. On RX-TEST PATTERN "carrying" data should be 11111111 11111111.

e) On the UUT 2851 set :-

TX-SUMMARY	Carrying	All 0

f) On the test equipment 2851 ensure that there are no receiver alarms. The RX-TEST PATTERN "carrying" data should be 00000000 00000000.

g) Change the Rx channel on the test equipment 2851 to channel 4. Ensure that there are no receiver alarms on the test equipment 2851. The carrying data should be 10101010 10101010 or 01010101 01010101.

2.3 Error injection

a) Connect the test equipment as shown in Fig. 6-4.

b) Set the UUT as follows :-

RECALL	Default	
TX-SUMMARY	TX	Off
	System	2MCnoMF
	TX	On
TX-ERROR INJECTION	Injection	Enabled
	Mode	Rate
	Rate	5E-5
	1st Target Bit	Framing
	Inject..	Bipolar violations
	...	Singly
CONFIGURE-OPTIONS	Errors LED Threshold	1E-9

c) Set the test equipment 2851 as follows :-

RECALL	Default	
RX-SYSTEM	System	2M/CnoMF
	Input Mode	Terminated
TEST-PARAMETERS	Major Error type	Line code
	Buzzer	Every Error

d) On the test equipment 2851

	TEST	Start

Wait 5 seconds.

On the RESULTS-MAJOR ERRORS page ensure that the total errors are increasing. The error LED should also light and the buzzer sound.

	TEST	Stop

3 Additional input/output tests

3.1 Analogue output

Specification
An applied "1 kHz 0 dBm digital sine wave" will produce an output level of 0 dBm ±0.5dB

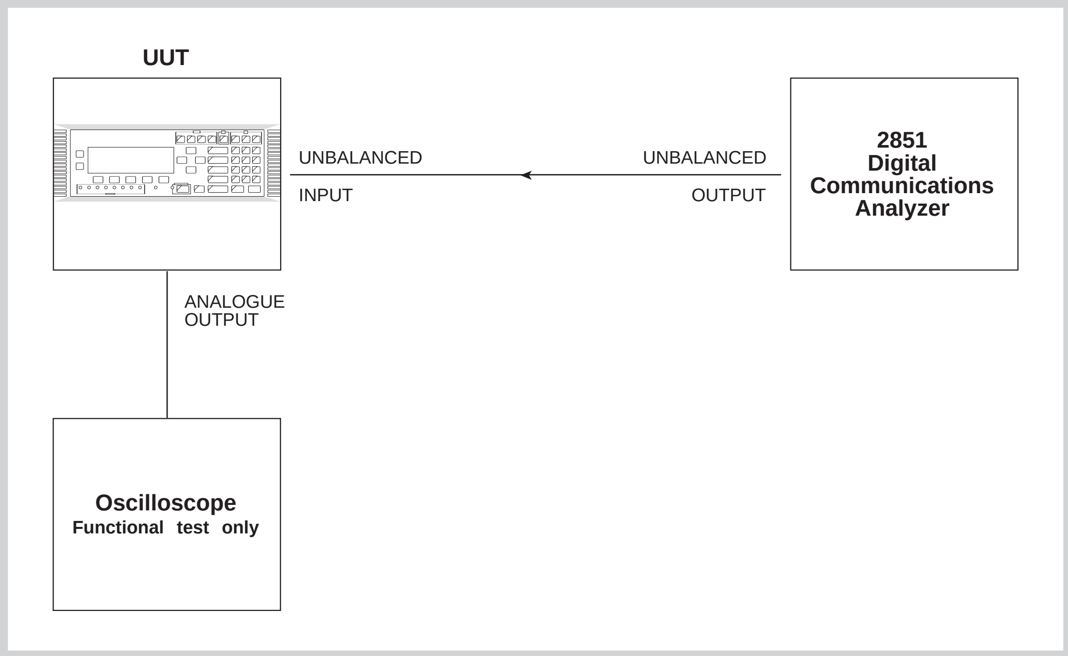


Fig. 6-5 Analogue output test set-up

a) Connect the test equipment as shown in Fig. 6-5.

b) Set the UUT as follows :-

RECALL-	Default	
TX-SUMMARY	TX	Off
RX-SYSTEM	System Input Mode Test Mode .. Channel	2M/32Fr Terminated Framed Single Channel 8
RX-TEST PATTERN	Sync to Speaker	External Voice On

c) Set the test equipment 2851 as follows :-

RECALL	Default	
TX-SUMMARY	TX System Test Mode .. Channel Carrying TX	Off 2M/32Fr Single Framed Channel 8 1 kHz 0 dBm0 On

d) This functional test can be carried out by connecting the audio output of the UUT to the oscilloscope. The peak to peak voltage should be approximately 4.0 V ±0.5 V pk-pk.

3.2 Analogue input

Specification
A 0.3 to 3.4 kHz band limited analogue signal can be fed in and inserted on to a selected channel. A 0 dBm signal at a frequency of 1 kHz will produce a"digital sine wave" of 0 dBm0 ±0.5 dB.

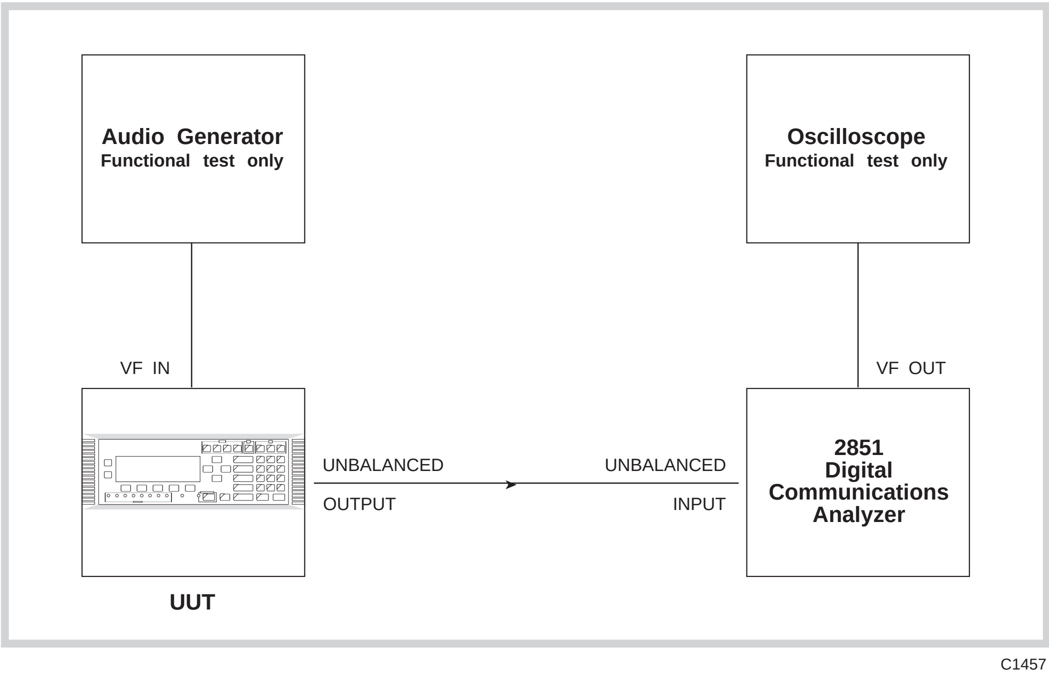


Fig. 6-6 Analogue input test set-up

a) Connect the test equipment as shown in Fig. 6-6.

b) Set the UUT as follows :-

RECALL	Default	
TX-SUMMARY	TX	Off
	Test Mode	Single Framed Channel
	.. Channel	8
	Carrying	External Voice
	TX	On

c) Set the test equipment 2851 as follows :-

RECALL	Default	
RX-SYSTEM	Input Mode	Terminated
	Test Mode	Framed Single Channel
	.. Channel	8
RX-TEST PATTERN	Sync to	External Voice
	Speaker	On

d) This functional test can be performed using the audio oscillator set to 1 kHz and 0 dBm. The peak to peak amplitude measured on the scope should be approximately 4.0 V ±0.5.V

3.3 Tributary insert tests - balanced data input

Specification
An external data stream can be inserted into one of the channels in the transmitted signal instead of a test pattern.

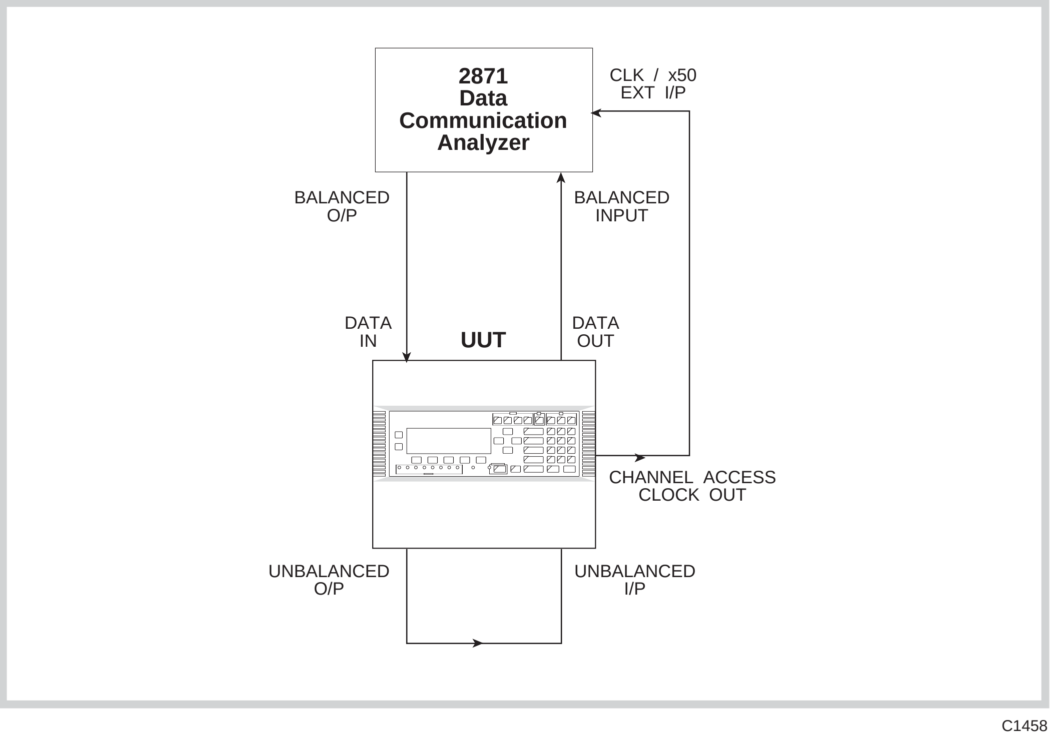


Fig. 6-7 Balanced data input test set-up

a) Connect the test equipment as shown in Fig. 6-7.

b) Set the UUT as follows :-

RECALL	Default		
TX-SUMMARY	TX	Off	
	System	2M/CRC	
	Test Mode	Single Framed Channel	
	.. Channel	8	
	Carrying	External data	
	TX	On	
TX-PATTERN	.. Data Code	Contra-directional	
	Fill Pattern	8 bit word	..11100111
RX-SYSTEM	System	2M/CRC	
	Input Mode	Terminated	
	Test Mode	Framed Single Channel	
	..Channel	8	
RX-TEST PATTERN	Sync to	External Data	
	..Data Code	Contra-directional	

c) Set the 2871 as follows :-

i) Transmitter

Interface	Balanced 120 Ω
Line Code	Contra-directional
Structure	Un-structured
Bit Rate	64 kbit/s
Clock Source	Ext Bal (contra input)
Test Pattern	Alternate
Time Out	None
Error Mode	Into Pattern
Error Rate	Manual
AIS Length	1
Signal Level	2.0 V

ii) Receiver

Interface	Balanced 120 Ω
Termination	Terminated
Line code	Contra-directional
Structure	Un-structured
Bit Rate	64 kbit/s
Timing source	Received Signal
Violation Lock	On
Test Pattern	Learn
Beeper	Off

d) Turn the transmitter ON and set the 2871 to RUN

e) On the 2871 MONITOR PATTERN ERRORS ensure that the learnt 16 bit word is an alternating pattern, this can be seen on the monitor test pattern.

3.4 Sync slips

Specification
The clock is extracted and compared to the receive input clock, the two being compared for synchronization. A slip is registered for each bit of relative phase shift. This facility is only available for 1.5 Mbit/s and 2 Mbit/s signals.

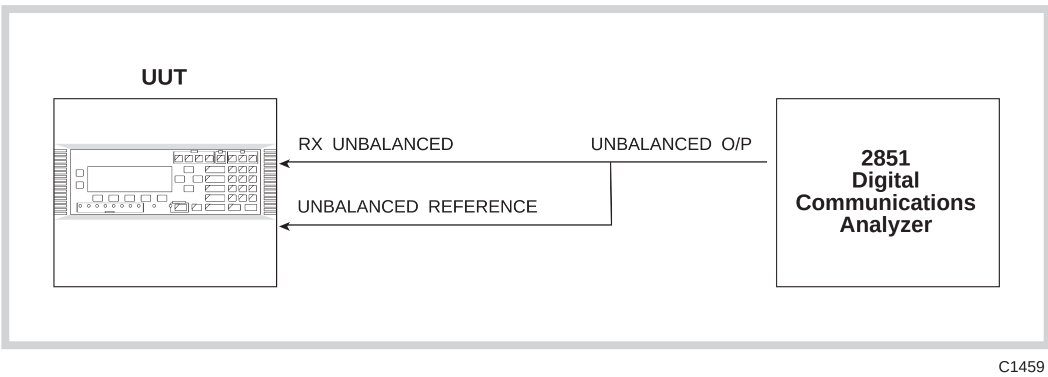


Fig. 6-8 Sync slips set-up

a) Connect the test equipment as shown in Fig. 6-8.

b) On the UUT select :-

RECALL	Default
RX-SYSTEM	Input mode Terminated
RESULTS-SYNC SLIPS	The Receive Frequency and the reference frequency should be the same with no slips displayed.

3.5 Output level tests

Specification	
The output levels should be within the following limits:-	
Balanced Output 120 Ω	Peak 3 V ±0.3 V Space 0 V ±0.3V
Unbalanced Output 75 Ω	Peak 2.37 V ±0.237 V Space 0 V ±0.237 V

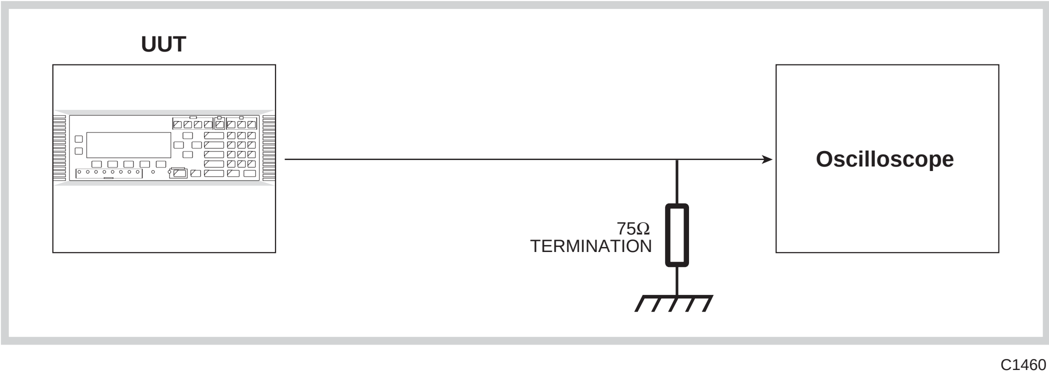


Fig. 6-9 Output level test set-up

a) Connect the test equipment as shown in Fig. 6-9.

b) Set the UUT as follows :-

RECALL	Default	
TX-SUMMARY	TX	Off
	Test Mode	Unframed
	Carrying	Alternating
	TX	On

c) Terminate the oscilloscope in 75 Ω. Adjust the scope so the trace is centred around 0 V. Using the cursors on the scope ensure that the peak voltage is 2.37 V ±0.237 V and the space voltage is 0 V ±0.237 V.

3.6 Receive line level measurement

Specification	
Range Accuracy	+3 dB to -35 dB 1.5 dB from +3 to -10 2 dB from -10 to -20 3 dB from -20 to -30

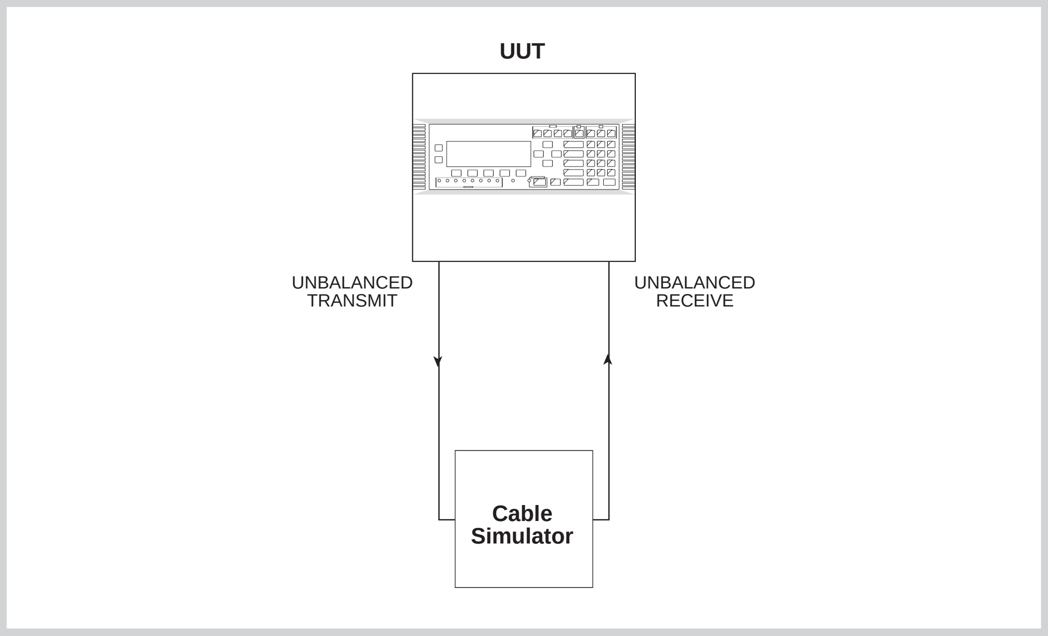


Fig. 6-10 Receive level test set-up

a) Connect the test equipment as shown in Fig. 6-10.

b) On the UUT select :-

RECALL	Default	
RX-SYSTEM	Input Mode Test Mode	Terminated Unframed
RX LINE LEVEL, FREQUENCY	RX Input	Unbalanced

c) Ensure that the line level is 0 dB ±1.5 dB

d) Introduce 9 dB of attenuation into the cable simulator and ensure that the level is 9 dB ±1.5 dB.

e) Introduce 19 dB of attenuation into the cable simulator and ensure that the level is 19 dB ±2.0 dB.

f) Introduce 29 dB of attenuation into the cable simulator and ensure that the level is 29 dB ±3.0 dB.

g) Repeat (c) to (f) using the balanced transmit and receive

3.7 DTMF

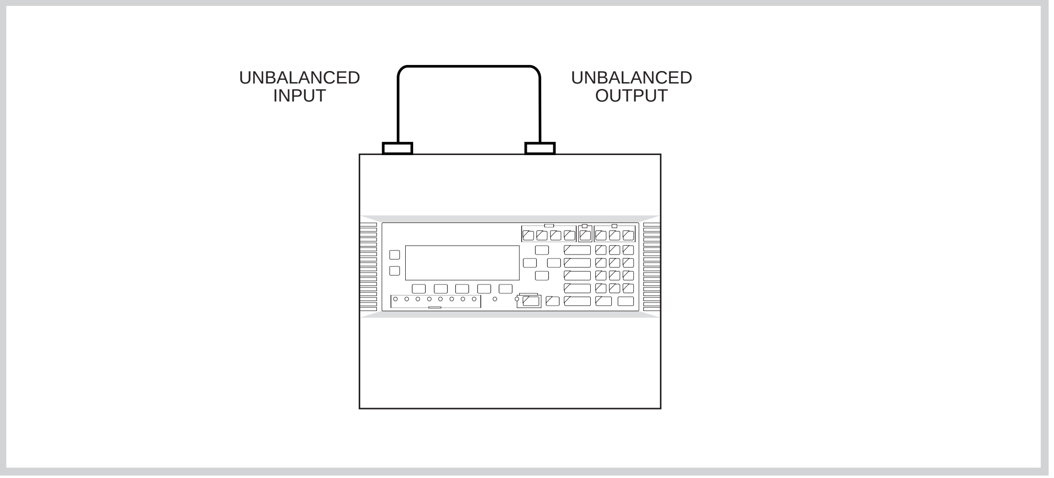


Fig. 6-11 DTMF test set-up

a) Connect the UUT as shown in Fig 6-11.

b) Select:

RECALL	Default		
TX-SUMMARY	Test mode	Framed single channel	
	..Channel	5	
	Carrying	External voice	
TX-SIGNALLING	Mode	DTMF	
	Dial Number	New No:	123456
RX-SYSTEM	Input mode	Terminated	
	Test mode	Framed single channel	
	..Channel	5	
RX-TEST PATTERN	Sync to	External voice	
	..Speaker	On	
RX-SIGNALLING MONITOR	Mode	DTMF	
	..Channel	5	
TX-SIGNALLING	Dial Number	Dial	
RX-SIGNALLING	Monitor		

c) Check that the dialled number reads 123456F and that the DTMF tone can be heard from the loudspeaker.

3.8 Propagation delay test

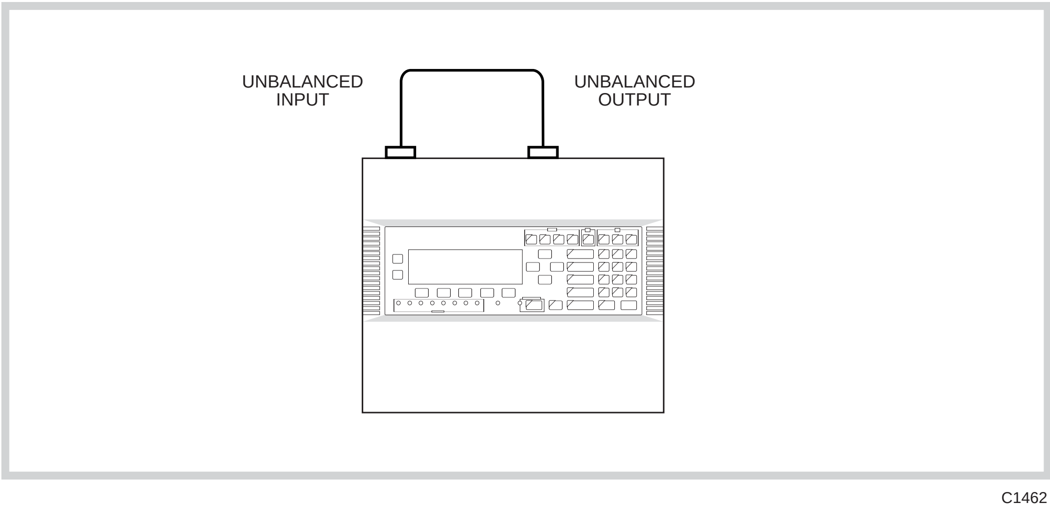


Fig. 6-12 Propagation delay test set-up

a) Connect the UUT as shown in Fig 6-12.

b) Select:

RECALL	Default	
TX-SUMMARY	Test mode	Unframed
RX-SYSTEM	Input Mode Test Mode	Terminated Unframed
RX-NETWORK PROP. DELAY	Mode	Execute

c) Check that the delay reads 0.000ms (= 0 bits)

Data interface tests

Specification
The following are FUNCTIONAL tests. In the event of suitable links not being available to test the data interfaces, kit L313 can be ordered from the Luton Service Division which provides ready made linked connectors. The V.11 interface tests are implicitly tested in the RS-449 procedure. A similar test can be performed for the V.10 interface by connecting the appropriate options lead and linking accordingly.

1 V.35
Not 2850B(S) or 2852(S)

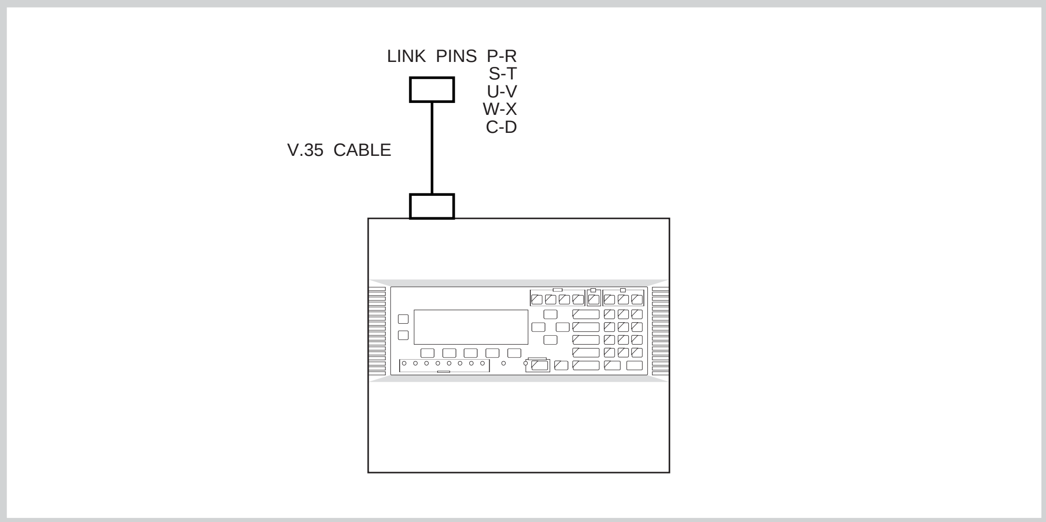


Fig. 6-13 Data interface V.35 test set-up

a) Connect the test equipment as shown in Fig 6-13.

b) Set the UUT as follows:

RECALL	Default		
TX-SUMMARY	Tx	Off	
	System	Data	V.35
	Bit rate	User	2500kbit/s
	Carrying	PRBS	
	Tx	On	
RX-SYSTEM	System	Data	V.35
	Bit rate	User	2500kbit/s

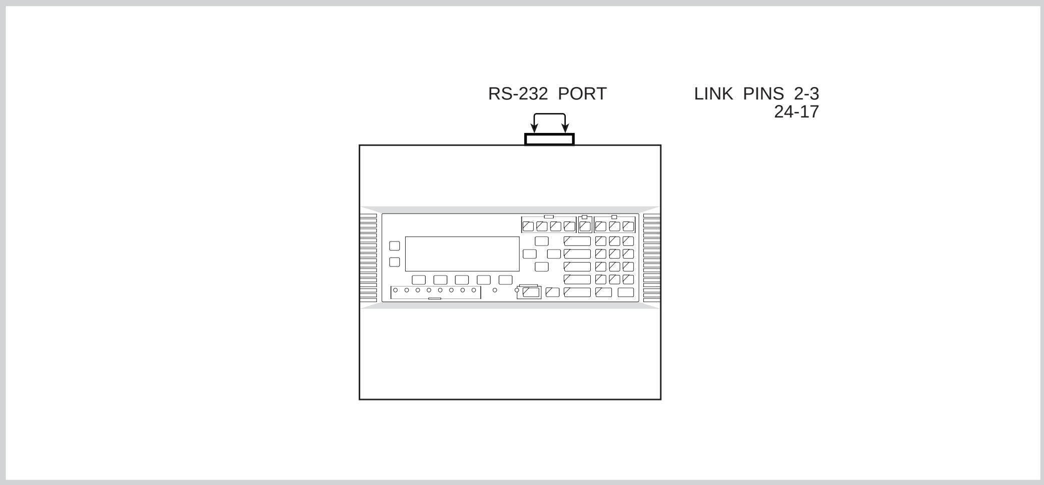
c) Check that no receiver alarms are indicated.

d) Set the UUT as follows:

RX-PATTERN

e) The carrying data should be continually changing.

2 RS-232 (SYNC)



C1464

Fig. 6-14 Data interface RS-232 test set-up

a) Connect the test equipment as shown in Fig 6-14.

b) Set the UUT as follows:

RECALL	Default		
TX-SUMMARY	Tx	Off	
	System	Data	
	Bit rate	User	80kbit/s
	Carrying	PRBS	
	Tx	On	
RX-SYSTEM	System	Data	
	Bit rate	User	80kbit/s

c) Check that no receiver alarms are indicated.

d) Set the UUT as follows:

RX-PATTERN

e) The carrying data should be continually changing.

3 RS-232 (ASYNC)

a) Set the UUT as follows (continuing from (e) above):

TX-SUMMARY	Test Mode	ASYNC
RX-SYSTEM	Test Mode	ASYNC

b) Check that no receiver alarms are indicated.

4 RS-449
Not 2850B(S) or 2852(S)

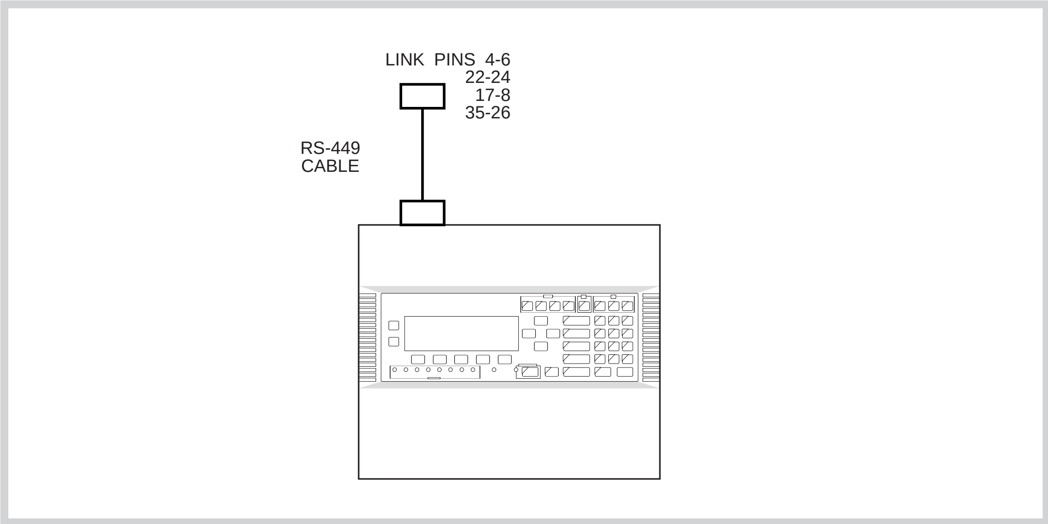


Fig. 6-15 Data interface RS-449 test set-up

a) Connect the test equipment as shown in Fig 6-15.

b) Set the UUT as follows:

RECALL	Default		
TX-SUMMARY	Tx	Off	
	System	Data	RS-449 (V.11)
DTE			
	Bit rate	User	2500kbit/s
	Carrying	PRBS	
	Tx	On	
RX-SYSTEM	System	Data	RS-449 (V.11)
DTE			
	Bit rate	User	2500kbit/s

c) Check that no receiver alarms are indicated.

d) Set the UUT as follows:

RX-PATTERN

e) The carrying data should be continually changing.

5 Contradirectional

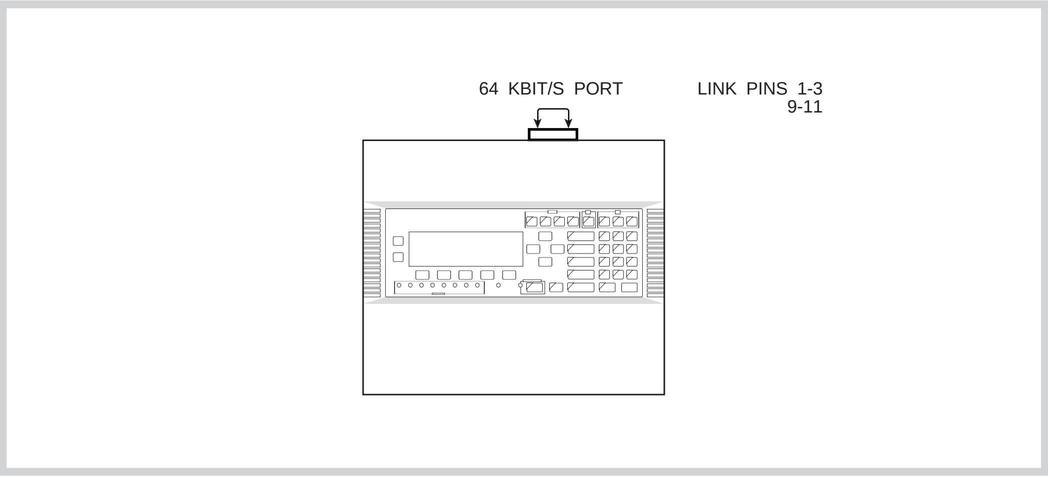


Fig. 6-16 Data interface contra directional test set-up

a) Connect the UUT as shown in Fig 6-16.

b) Set the UUT as follows:

RECALL	Default		
TX-SUMMARY	TX	Off	
	System	Data	Contra
	Tx	On	
RX-SYSTEM	System	Data	Contra

c) Check that no receiver alarms are displayed.

X.50 systems Option 24

2850B(S) and 2851(S) only

Specification
The following are FUNCTIONAL tests. In the event of suitable links not being available use the 64 kbit/s loopback connector in kit L313 to perform these tests. The 2850BS and 2851S contain all three X.50 interfaces so all the X.50 tests that follow will apply. 2850B and 2851 will have a maximum of two interfaces in any combination. Refer to the rear panel to establish which of the following tests need to be performed.

1 X.50 BAL 120 Interface

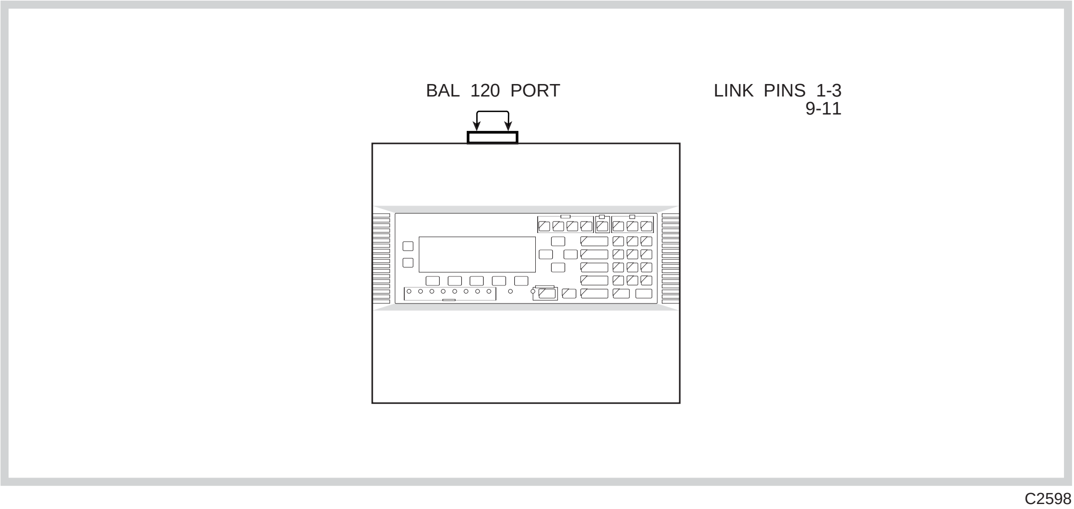


Fig. 6-17   X.50 BAL 120 Interface test set-up

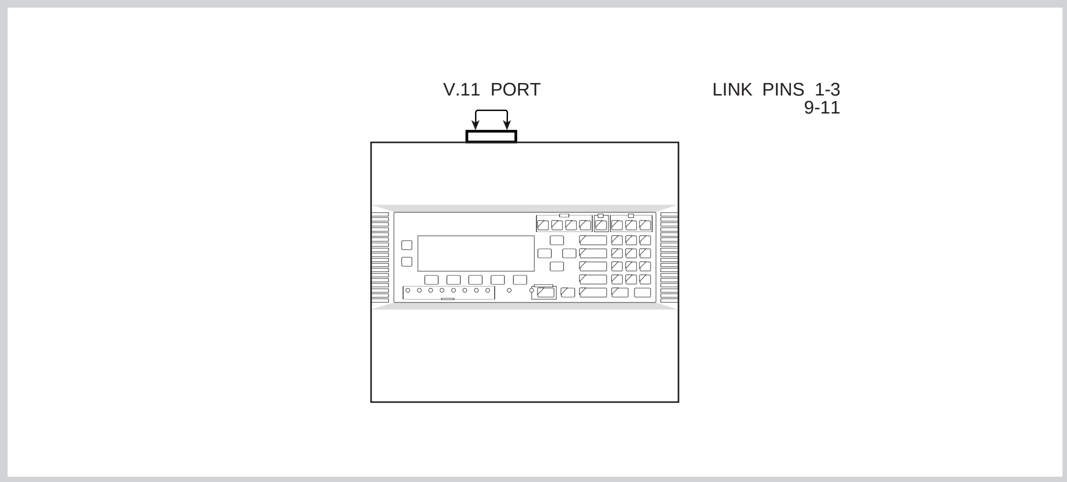
a) Connect the UUT as shown in Fig 6-17.

b) Set the UUT as follows:

RECALL	Default	
TX-PCM MENU	MODE	SDATA
TX-SUMMARY	Interface	BAL 120
RX-PCM MENU	MODE	SDATA
RX-SYSTEM	Interface	BAL 120

c) Check that no receiver alarms are displayed.

2 X.50 BAL V11 Interface



C2599

Fig. 6-18 X.50 BAL V11 Interface test set-up

a) Connect the UUT as shown in Fig 6-18.

b) Set the UUT as follows:

RECALL	Default	
TX-PCM MENU	MODE	SDATA
TX-SUMMARY	Interface Structure	BAL V11 STRUC 7
RX-PCM MENU	MODE	SDATA
RX-SYSTEM	Interface Structure	BAL V11 STRUC 7

c) Check that no receiver alarms are displayed.

3 X.50 BIN TTL Interface

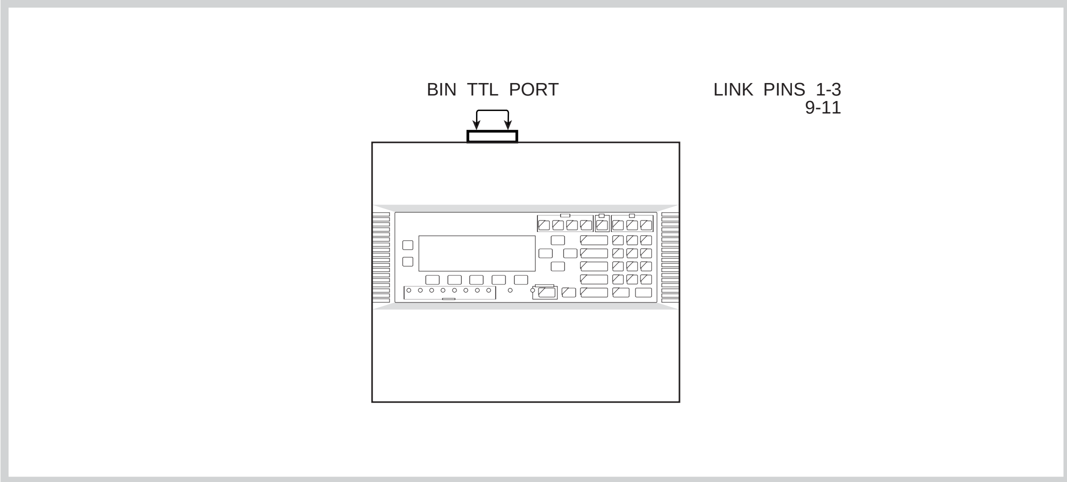


Fig. 6-19 X.50 BIN TTL Interface test set-up

a) Connect the UUT as shown in Fig 6-19.

b) Set the UUT as follows:

RECALL	Default	
TX-PCM MENU	MODE	SDATA
TX-SUMMARY	Interface Line Code	BIN TTL B/P(M)
RX-PCM MENU	MODE	SDATA
RX-SYSTEM	Interface Line Code	BIN TTL B/P(M)

c) Check that no receiver alarms are displayed.

d) Set the UUT as follows:

TX-SUMMARY	Structure	UNSTRUC
RX-SYSTEM	Structure	UNSTRUC

e) Check that no receiver alarms are displayed.

704 kbit/s systems Option 03, 04, 07

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 704 kbit/s ±50 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 704 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	704 k
Test equipment	TX-SUMMARY	System	704 k

c) For section (d) check that the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 704.014	Min 703.986	Max 20	Min -20

d) For section (e) select the following bit rate :-

..Rate : 704 kbit/s ..Offset 50 ppm

e) Repeat (e) with a Transmit bit rate offset of -50 ppm.

1.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 704 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	704k
Test equipment	TX-SUMMARY	System	704k

1.3 Error measurement

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 704 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	704k
Test equipment	TX-SUMMARY	System	704k
	TX-ERROR INJECTION	Inject..	Bit Errors

1.4 Input sensitivity

Specification
The input sensitivity is as follows :- 3 V +2 dB to -6 dB

a) Follow the tests as detailed for non ALBO 2048 kbit/s.

b) Select 704 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	704k
Test equipment	TX-SUMMARY	System	704k

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±10 ppm from 0°C to 55°C ±3 ppm aging rate per year

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 704 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	704k
Test equipment	RX-SYSTEM	System	704k

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 704.014	Min 703.986	Max 20	Min -20

d) For section (e) select a bit rate of :-

..Rate 800 kbit/s

Check the bit rate to the following limits :-

Bit rate (kbit/s)	
Max 800.016	Min 799.984

e) For section (f) select a bit rate of 608 kbit/s. Ensure that the received bit rate is within the limits shown.

Bit rate (kbit/s)	
Max 608.012	Min 607.988

2.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 704 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	704k
Test equipment	RX-SYSTEM	System	704k

2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 704 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	704k
Test equipment	RX-SYSTEM	System	704k

1544 kbit/s systems Option 02, 04, 05

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 1544 kbit/s ±130 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	T1SFns
Test equipment	TX-SUMMARY	System	T1SFns

c) For section (d) check the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 1 544.031	Min 1 543.969	Max 20	Min -20

d) For section (e) select the following bit rate :-

..Rate : 1544 kbit/s   ..Offset 125 ppm

e) Repeat (e) with a Transmit bit rate offset of -125 ppm.

1.2 Test patterns

a) Connect the test equipment as shown in Fig. 6-1.

b) Set up the UUT as follows :-

RECALL	Default	
RX-SYSTEM	System Input Mode	T1SF Terminated
RX-TEST PATTERN	Sync to ..	QRSS

c) Set the test equipment 2851 up as follows :-

RECALL	Default	
TX-SUMMARY	TX System TX	Off T1SF On
TX-PATTERN	Carrying	QRSS

d) On the UUT select :-

RX-TEST PATTERN

Ensure that there are no receive alarms on the UUT 2851 and that the "carrying" data is continually changing.

e) On the test equipment 2851 select :-

TX-PATTERN	Carrying	All 1

On the UUT select:-

RX-TEST PATTERN	Sync to	Repetitive word

Repeat the procedure in (d), ensure that there are no receiver alarms and that the "carrying" data is 11111111 11111111.

1.3 Error measurement

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	T1SFns
Test equipment	TX-SYSTEM	System	T1SFns
	TX-ERROR INJECTION	Inject..	Bit Errors

1.4 Input sensitivity

Specification
The input sensitivity is as follows :- 3 V +2 dB to -6 dB

a) Follow the tests as detailed for non ALBO 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	T1SF
Test equipment	TX-SYSTEM	System	T1SF

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±10 ppm from 0°C to 55°C ±3 ppm aging rate per year

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1SF
Test equipment	RX-SYSTEM	System	T1SF

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max	Min	Max	Min
1 544.031	1 543.969	20	-20

d) For section (e) select a bit rate of :-

..Rate 1 640 kbit/s

Check the bit rate to the following limits :-

Bit rate (kbit/s)	
Max	Min
1 640.033	1 639.967

e) For section (f) select a bit rate of 1488 kbit/s. Ensure that the received bit rate is within the limits shown.

Bit rate (kbit/s)	
Max	Min
1 448.030	1 447.970

2.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1SF
Test equipment	RX-SYSTEM	System	T1SF

2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1SF
Test equipment	RX-SYSTEM	System	T1SF

3 Additional input/output tests

3.1 Analogue output

Specification
An applied "1 kHz, 0 dBm digital sine wave" will produce an output level of 0 dBm ±0.5 dB.

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1SF
Test equipment	RX-SYSTEM	System	T1SF

3.2 Analogue input

Specification
A 0.3 to 3.4 kHz band limited analogue signal can be fed in and inserted onto a selected channel. A 0 dBm signal at a frequency of 1 kHz will produce a "digital sine wave" of 0 dBm0 ±0.5 dB.

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1SF
Test equipment	RX-SYSTEM	System	T1SF

3.3 Tributary insert tests - balanced data input

Specification
An external data stream can be inserted into one of the channels in the transmitted signal instead of a test pattern.

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1SF
Test equipment	RX-SYSTEM	System	T1SF

3.4 Sync slips

Specification
The clock is extracted and compared to the receive input clock, the two being compared for synchronization. A slip is registered for each bit of relative phase shift. This facility is only available for 1.5 Mbit/s and 2 Mbit/s signals.

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1SF
Test equipment	RX-SYSTEM	System	T1SF

3.5 Output level tests

<table>
<tr><th colspan="3">Specification</th></tr>
<tr><td colspan="3">The output levels should be within the following limits:</td></tr>
<tr><td>Balanced Output 110 Ω</td><td>Peak
Space</td><td>3 V ±0.3 V
0 V ±0.3V</td></tr>
<tr><td>Unbalanced Output 75 Ω</td><td>Peak
Space</td><td>2.37 V ±0.237 V
0 V ±0.237 V</td></tr>
</table>

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1SF
Test equipment	RX-SYSTEM	System	T1SF

3.6 Receive line level measurement

Specification	
Range	+3 dB to -35 dB
Accuracy	1.5 dB from -3 to -10 2 dB from -10 to -20 3 dB from -20 to -30

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1544 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1SF
Test equipment	RX-SYSTEM	System	T1SF

3152 kbit/s systems Option 04, 05

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 3152 kbit/s ±30 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	T1C/M1
Test equipment	TX-SUMMARY	System	T1C/M1

c) For section (d) check the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 3 152.063	Min 3 151.937	Max 20	Min -20

d) For section (e) select the following bit rate :-

..Rate : 3152 kbit/s ..Offset 25 ppm

e) Repeat (e) with a Transmit bit rate offset of -25 ppm

1.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	T1C/M1
Test equipment	TX-SUMMARY	System	T1C/M1

1.3 Error measurement

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	T1C\M1
Test equipment	TX-SUMMARY	System	T1C\M1
	TX-ERROR		
	INJECTION	Inject..	Bit Errors
		..	Singly

1.4 Input sensitivity

Specification
The input sensitivity is 3 V +2 dB to -6 dB

a) Follow the tests as detailed for non ALBO 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	T1C/M1
Test equipment	TX-SUMMARY	System	T1C/M1

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±10 ppm from 0°C to 55°C ±3 ppm aging rate per year

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1C/M1
Test equipment	RX-SUMMARY	System	T1C/M1

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 3 152.030	Min 3 151.970	Max 20	Min -20

d) For section (e) select a bit rate of :-

..Rate 3248 kbit/s

Check the bit rate to the following limits :-

Bit rate (kbit/s)	
Max 3 248.065	Min 3 247.935

e) For section (f) select a bit rate of 3056 kbit/s. Ensure that the received bit rate is within the limits shown.

Bit rate (kbit/s)	
Max 3 056.061	Min 3 055.939

2.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1ESF
Test equipment	RX-SUMMARY	System	T1ESF

2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1C/M1
Test equipment	RX-SUMMARY	System	T1C/M1

6312 kbit/s systems Option 04, 05

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation: 6312 kbit/s ±33 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 6312 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	6M/IW
Test equipment	TX-SUMMARY	System	6M/IW

c) For section (d) check the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 6 312.126	Min 6 311.874	Max 20	Min -20

d) For section (e) select the following bit rate :-

..Rate : 6312 kbit/s ..Offset 25 ppm

e) Repeat (e) with a Transmit bit rate offset of -25 ppm.

1.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 6312 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	6M/IW
Test equipment	TX-SUMMARY	System	6M/IW

1.3 Error measurement

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 6312 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	T2async
Test equipment	TX-SUMMARY	System	T2async
	Tx-ERROR INJECTION	Inject.. ..	Bit Errors Singly

1.4 Input sensitivity

Specification
The input sensitivity is 3 V +2 dB to -6 dB

a) Follow the tests as detailed for non ALBO 2048 kbit/s.

b) Select 6312 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	6M/IW
Test equipment	TX-SUMMARY	System	6M/IW

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±10 ppm from 0°C to 55°C ±3 ppm aging rate per year

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 6312 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	6M/IW
Test equipment	RX-SYSTEM	System	6M/IW

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 6 312.126	Min 6 311.874	Max 20	Min -20

d) For section (e) select a bit rate of :-

..Rate 6 408 kbit/s

Check the bit rate to the following limits :-

Bit rate (kbit/s)	
Max 6 408.128	Min 6 407.872

e) For section (f) select a bit rate of 6216 kbit/s. Ensure that the received bit rate is within the limits shown.

Bit rate (kbit/s)	
Max 6 216.124	Min 6 215.876

2.2 Test patterns

a) Connect the test equipment as shown in Fig. 6-1.

b) Set up the test equipment 2851 as follows :-

RECALL	Default	
RX-SYSTEM	System Input Mode	6M/IW Terminated
RX-TEST PATTERN	Sync to	Repetitive Word

c) Set the UUT 2851 up as follows :-

RECALL	Default	
TX-SUMMARY	TX System TX	Off 6M/IW On
TX-PATTERN	Carrying	All 0

d) On the UUT 2851 select :-

RX-TEST PATTERN

Ensure that there are no receive alarms on the UUT 2851 and that the "carrying" data is 00000000 00000000.

e) On the test equipment 2851 select :-

TX-PATTERN	Carrying	All 1

Repeat the procedure in (d), ensure that there are no receiver alarms and that the "carrying" data is 11111111 11111111.

2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 6312 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	6M/IW
Test equipment	RX-SYSTEM	System	6M/IW

8448 kbit/s systems Option 01, 07

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 8448 kbit/s ±30 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 8448 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	8M/742
Test equipment	TX-SUMMARY	System	8M/742

c) For section (d) check the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max	Min	Max	Min
8 448.169	8 447.831	20	-20

d) For section (e) select the following bit rate :-

..Rate : 8448 kbit/s ..Offset 25 ppm

e) Repeat (e) with a Transmit bit rate offset of -25 ppm.

1.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 8448 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	8M/745
Test equipment	TX-SUMMARY	System	8M/745

1.3 Error measurement

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 8448 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	8M/744
Test equipment	TX-SUMMARY	System	8M/744
	TX-ERROR INJECTION	Inject..	Bit Errors

1.4 Input sensitivity

Specification
The input sensitivity is 3 V +2 dB to -6 dB

a) Follow the tests as detailed for non ALBO 2048 kbit/s.

b) Select 8448 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	8M/741
Test equipment	TX-SUMMARY	System	8M/741

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±10 ppm from 0°C to 55°C ±3 ppm aging rate per year

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 8448 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	8M/742
Test equipment	RX-SYSTEM	System	8M/742

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max	Min	Max	Min
8 448.169	8 447.831	20	-20

d) For section (e) select a bit rate of :-

..Rate 8544 kbit/s

Check the bit rate to the following limits :-

Bit rate (kbit/s)	
Max	Min
8544.171	8543.829

e) For section (f) select a bit rate of 8352 kbit/s. Ensure that the received bit rate is within the limits shown.

Bit rate (kbit/s)	
Max	Min
8352.167	8351.833

2.2 Test patterns

a) Connect the test equipment as shown in Fig. 6-1.

b) Set up the test equipment 2851 as follows :-

RECALL	Default	
RX-SYSTEM	System	8M/742
	Input Mode	Terminated
RX-TEST PATTERN	Sync to	Repetitive Word

c) Set the UUT 2851 up as follows :-

RECALL	Default	
TX-SUMMARY	TX	Off
	System	8M/742
	TX	On
TX-PATTERN	Carrying	All 0

d) On the UUT 2851 select :-

RX-TEST PATTERN

Ensure that there are no receive alarms on the UUT 2851 and that the "carrying" data is 00000000 00000000.

e) On the test equipment 2851 select :-

TX-PATTERN	Carrying	All 1

Repeat the procedure in (d), ensure that there are no receiver alarms and that the "carrying" data is 11111111 11111111.

2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 8448 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	8M/742
Test equipment	RX-SYSTEM	System	8M/742

256 kbit/s systems Option 01, 25

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 256 kbit/s ±100 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 256 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	256k
Test equipment	TX-SUMMARY	System	256k

c) For section (d) check the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max	Min	Max	Min
256.005	255.995	20	-20

d) For section (e) select the following bit rate :-

..Rate : 256 kbit/s ..Offset 100 ppm

e) Repeat (e) with a Transmit bit rate offset of -100 ppm

1.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 256 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	256k
Test equipment	TX-SUMMARY	System	256k

1.3 Error measurement-

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 256 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	256k
Test equipment	TX-SUMMARY	System	256k
	TX-ERROR		
	INJECTION	Inject..	Bit Errors
		..	Singly

1.4 Input sensitivity

Specification
The input sensitivity is 3 V +2 dB to -6 dB

a) Follow the tests as detailed for non ALBO 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	256k
Test equipment	TX-SUMMARY	System	256k

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±10 ppm from 0°C to 55°C ±3 ppm ageing rate per year

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	256k
Test equipment	RX-SUMMARY	System	256k

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 256.005	Min 255.995	Max 20	Min -20

2.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1ESF
Test equipment	RX-SUMMARY	System	T1ESF

2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 3152 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	T1C/M1
Test equipment	RX-SUMMARY	System	T1C/M1

512 kbit/s systems Option 01, 25

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 512 kbit/s ±100 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 512 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	512k
Test equipment	TX-SUMMARY	System	512k

c) For section (d) check the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 512.010	Min 511.990	Max 20	Min -20

d) For section (e) select the following bit rate :-

..Rate : 512 kbit/s ..Offset 100 ppm

e) Repeat (e) with a Transmit bit rate offset of -100 ppm

1.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 512 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	512k
Test equipment	TX-SUMMARY	System	512k

1.3 Error measurement

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 512 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	512k
Test equipment	TX-SUMMARY	System	512k
	TX-ERROR		
	INJECTION	Inject..	Bit Errors
		..	Singly

1.4 Input sensitivity

Specification
The input sensitivity is 3 V +2 dB to -6 dB

a) Follow the tests as detailed for non ALBO 2048 kbit/s.

b) Select 512 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	512k
Test equipment	TX-SUMMARY	System	512k

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±10 ppm from 0°C to 55°C ±3 ppm ageing rate per year

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 512 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	512k
Test equipment	RX-SUMMARY	System	512k

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 512.010	Min 511.990	Max 20	Min -20

2.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 512 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	512k
Test equipment	RX-SUMMARY	System	512k

2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 512 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	512k
Test equipment	RX-SUMMARY	System	512k

1024 kbit/s systems Option 01, 25

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 1024 kbit/s ±100 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 1024 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	1024k
Test equipment	TX-SUMMARY	System	1024k

c) For section (d) check the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 1024.020	Min 1023.980	Max 20	Min -20

d) For section (e) select the following bit rate :-

..Rate : 1024 kbit/s ..Offset 100 ppm

e) Repeat (e) with a Transmit bit rate offset of -100 ppm

1.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1024 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	1024k
Test equipment	TX-SUMMARY	System	1024k

1.3 Error measurement

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1024 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	1024k
Test equipment	TX-SUMMARY	System	1024k
	TX-ERROR INJECTION	Inject..	Bit Errors
		..	Singly

1.4 Input sensitivity

Specification
The input sensitivity is 3 V +2 dB to -6 dB

a) Follow the tests as detailed for non ALBO 2048 kbit/s.

b) Select 1024 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	RX-SYSTEM	System	1024k
Test equipment	TX-SUMMARY	System	1024k

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±10 ppm from 0°C to 55°C ±3 ppm ageing rate per year

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1024 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	1024k
Test equipment	RX-SUMMARY	System	1024k

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 1024.020	Min 1023.980	Max 20	Min -20

2.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1024 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	1024k
Test equipment	RX-SUMMARY	System	1024k

2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 1024 kbit/s on the UUT and the test equipment 2851 as follows :-

UUT	TX-SUMMARY	System	1024k
Test equipment	RX-SUMMARY	System	1024k

34 Mbit/s systems 2852(S) & 2853(S)

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 34368 kbit/s ±60 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 34368 kbit/s on the UUT and the test equipment 2852 as follows :-

UUT	RX-SYSTEM	System	34M
Test equipment	TX-SUMMARY	System	34M

c) For section (d) check the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 34 368.137	Min 34 367.863	Max 4	Min -4

d) For section (e) select the following offset :-

..Offset 60 ppm

e) Repeat (e) with a Transmit bit rate offset of -60 ppm.

1.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 34368 kbit/s on the UUT and the test equipment 2852 as follows :-

UUT	RX-SYSTEM	System	34M
	RX-TEST PATTERN	Sync to	8 Bit word
Test equipment	TX-SUMMARY	System	34M
	TX-PATTERN	Carrying	8 Bit word

c) For section (d) the Carrying data is 01010101.

1.3 Error measurement

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 34368 kbit/s on the UUT and the test equipment 2852 as follows :-

UUT	RX-SYSTEM	System	34M
Test equipment	TX-SUMMARY	System	34M
	TX-ERROR INJECTION	Inject..	Bit Errors

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±2 ppm from 0°C to 55°C

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 34368 kbit/s on the UUT and the test equipment 2852 as follows :-

UUT	TX-SUMMARY	System	34M
Test equipment	RX-SYSTEM	System	34M

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 34 368.137	Min 34 367.863	Max 4	Min -4

2.2 Test patterns

a) Connect the test equipment as shown in Fig. 6-1.

b) Set up the test equipment 2852 as follows :-

RECALL	Default	
RX-SYSTEM	System Input Mode	34M Terminated
RX-TEST PATTERN	Sync to	16 Bit word

c) Set the UUT 2852 up as follows :-

RECALL	Default	
TX-SUMMARY	TX System TX	Off 34M On
TX-PATTERN	Carrying	16 Bit word

d) On the UUT 2852 select :-

RX-TEST PATTERN

Ensure that there are no receive alarms on the UUT 2852 and that the "carrying" data is 01010101 01010101.

2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 34368 kbit/s on the UUT and the test equipment 2852 as follows :-

UUT	TX-SUMMARY	System	34M
	TX-ERROR INJECTION	1st Target Bit	Pattern
Test equipment	RX-SYSTEM	System	34M

3 Mux/demux tests
Option 14 only

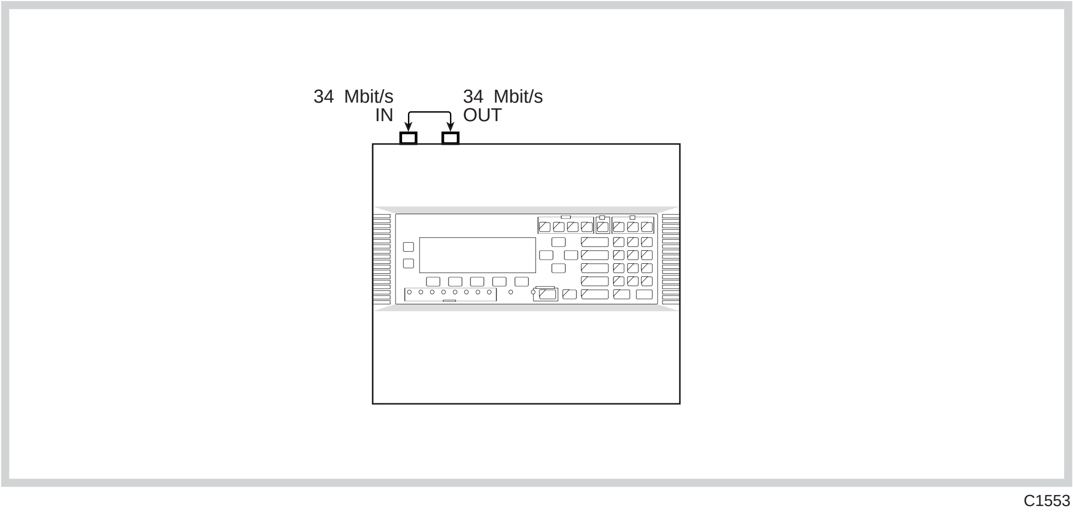


Fig. 6-20 Mux/demux test set-up

a) Connect the UUT as shown in Fig. 6-20.

b) Set the UUT as follows:

RECALL	Default	
TX-SUMMARY	TX System TX	Off 2M On
TX-MUX CONTROL	Mux	On
RX-SYSTEM	System	2M
RX-DEMUX CONTROL	Demux	On

c) Check that no receiver alarms are displayed.

4 34 Mbit/s NRZ tests

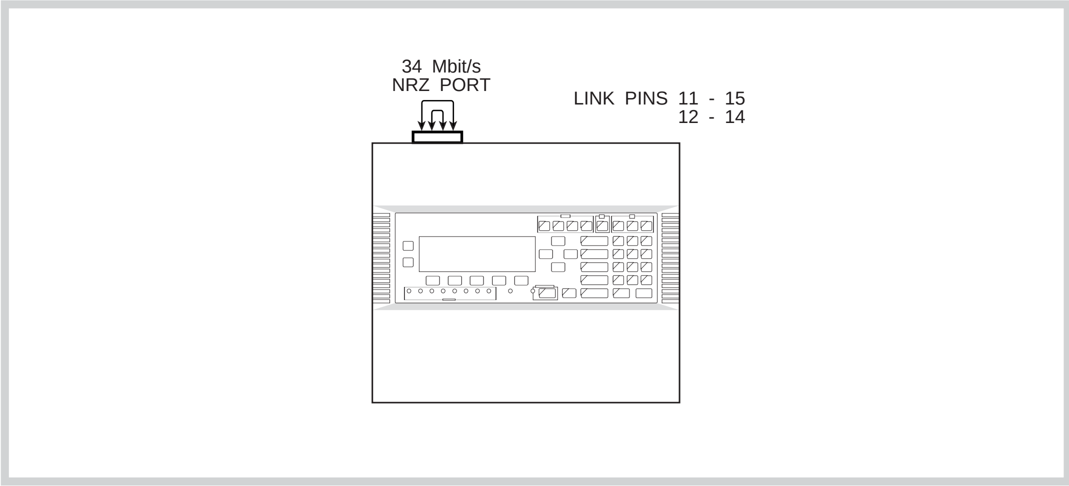


Fig. 6-21 34 Mbit/s NRZ test set-up

a) Connect the UUT as shown in Fig. 6-21.

b) Set the UUT as follows:

RECALL	Default	
TX-SUMMARY	TX	Off
	System	34M
	TX	On
RX-SYSTEM	System	34M
	Input mode	NRZ

c) Check that no receiver alarms are displayed.

140 Mbit/s systems 2854S & 2855S

1 Receiver tests

1.1 Bit rate measurement

Specification
The receiver will operate correctly with the variation:- 139264 kbit/s ±60 ppm

a) Follow steps detailed for 2048 kbit/s.

b) Select 139264 kbit/s on the UUT and the test equipment 2854S as follows :-

UUT	RX-SYSTEM	System	140M
Test equipment	TX-SUMMARY	System	140M

c) For section (d) check the bit rates are within the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 139 264.557	Min 139 263.443	Max 4	Min -4

d) For section (e) select the following offset :-

..Offset 60 ppm

e) Repeat (e) with a Transmit bit rate offset of -60 ppm.

1.2 Test patterns

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 139264 kbit/s on the UUT and the test equipment 2854S as follows :-

UUT	RX-SYSTEM	System	140M
	RX-TEST PATTERN	Sync to	24 Bit word
Test equipment	TX-SUMMARY	System	140M

c) For section (d) the Carrying data is 00000000 00000000 00000000.

d) For section (e) the Carrying data is 11111111 11111111 11111111.

1.3 Error measurement

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 139264 kbit/s on the UUT and the test equipment 2854S as follows :-

UUT	RX-SYSTEM	System	140M
Test equipment	TX-SUMMARY	System	140M
	TX-ERROR INJECTION	Inject..	Bit Errors

2 Transmitter tests

2.1 Bit rate test

Specification	
Internal clock accuracy :	±2 ppm from 0°C to 55°C

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 139264 kbit/s on the UUT and the test equipment 2854S as follows :-

UUT	TX-SUMMARY	System	140M
Test equipment	RX-SYSTEM	System	140M

c) For section (d) check the bit rate to the following limits :-

Bit rate (kbit/s)		Offset (ppm)	
Max 139 264.557	Min 139 263.443	Max 4	Min -4

2.2 Test patterns

a) Connect the test equipment as shown in Fig. 6-1.

b) Set up the test equipment 2854S as follows :-

RECALL	Default	
RX-SYSTEM	System	140M
RX-TEST PATTERN	Sync to	16 Bit word

c) Set the UUT 2854S up as follows :-

RECALL	Default	
TX-SUMMARY	TX System TX	Off 140M On
TX-PATTERN	Carrying	16 Bit word

d) On the UUT 2854S select :-

RX-TEST PATTERN

Ensure that there are no receive alarms on the UUT 2854S and that the "carrying" data is 01010101 01010101.

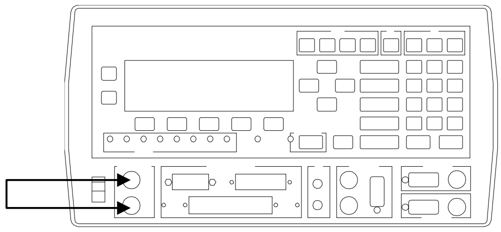
2.3 Error injection

a) Follow the tests as detailed for 2048 kbit/s.

b) Select 139264 kbit/s on the UUT and the test equipment 2854S as follows :-

UUT	TX-SUMMARY	System	140M
	TX-ERROR INJECTION	1st Target Bit	Pattern
Test equipment	RX-SYSTEM	System	140M

3 Mux/demux tests



140M OUT-
140M IN

Fig. 6-22 Mux/demux test set-up

a) Connect the UUT as shown in Fig. 6-**Error! Bookmark not defined.**.

b) Set the UUT as follows:

RECALL	Default	
TX-MUX CONTROL	Mux	On
RX-DEMUX CONTROL	Demux	On

c) Check that no receiver alarms are displayed.

3.1 Framed error injection

a) Connect the UUT as shown in Fig. 6-20.

b) Set the UUT as follows :-

RECALL	Default	
TX-MUX CONTROL	Mux	On
TX-ERROR INJECTION	Injection	Enabled
	Mode	Rate
	Rate	5E-5
	1st Target Bit	140M Framing
RX-DEMUX CONTROL	Demux	On
TEST-PARAMETERS	Major Error type	140M Frame Word
	Buzzer	Every Error
	TEST	Start

Wait 5 seconds.

On the RESULTS-MAJOR ERRORS page ensure that the total errors are increasing. The error LED should light and the buzzer sound.

	TEST	Stop

Appendix A
DEFAULT INSTRUMENT SETTINGS

The 2851 parameters, options and values will default to specific settings on the following transitions:

Mode of operation changed

PCM or Data Tx-system is changed

PCM or Data Rx-system is changed

PCM Tx-system Test mode or Rx-system Test mode is changed

PCM+SD mode is selected

Fixed configuration store is recalled

Self-test failure on power-up occurs.

Note

(1) Re-selecting the same Tx or Rx System has the same effect as changing the Tx or Rx system.

(2) Not all parameters listed apply to all SYSTEMS.

(3) Ignore the parameters listed that are not relevant to the SYSTEM selected on your 2851.

(4) Not all parameters listed are active, i.e. they are not displayed unless associated default parameters are changed by you; e.g. TEST MODE is automatically defaulted to FRAMED but if you then change TEST MODE to SINGLE, FILL PATTERN is displayed defaulted to PRBS. If you change FILL PATTERN to WORD, the FILL PATTERN defaults to 8 BIT WORD ...01010101.

(5) * = Option/Value depends on the System selected.

(6) Mux/Demux operation is for 2M, 8M or 34M systems. If a compatible system is not already selected, MUX = ON or DEMUX = ON forces 2M system (if MUX/DEMUX - 2M is selected) or 8M/742 system (if MUX/DEMUX - 8M is selected) or 34M system (if MUX/DEMUX - 34M is selected).

Tx & Rx settings when Mode of operation changed

PCM, DATA and SDATA modes. - When a new mode is selected the Tx and Rx settings from the last operation in that mode are reloaded.

PCM+SDATA mode. - When the combined PCM+SD mode of operation is selected the previous PCM and SDATA mode settings are reloaded plus the following parameter defaults:

Parameter			**Option/Value**
Tx			
SDATA	TX_SUMMARY		
		INTERFACE	PCM CH
PCM	TX_TEST PATTERN		
		TEST MODE	FRAMED SINGLE CHANNEL
		CARRYING	STRUCTURED DATA

Parameter			**Option/Value**
RX			
SDATA	RX_SYSTEM		
		INTERFACE	PCM CH
PCM	RX_TEST PATTERN		
		TEST MODE	FRAMED SINGLE CHANNEL
		SYNC TO	STRUCTURED DATA

Default settings when TX-system changed

These are the parameter options and values which the 2851 defaults to if TX-SYSTEM is changed or if the same TX-SYSTEM is re-selected at any time by the user.

Parameter	**Option/Value**
TX	OFF

PCM systems

TX-SUMMARY		
SYSTEM*	User selected.	
CODE*	HDB3:-	256K, 512K, 704K, 1024K, 2M, 2M/noMF, 2M/CRC, 2M/CnoMF, 2M/32Fr, 8M/742, 8M/745, 8M/744, 8M/741, 34M NON STD.
	AMI:-	T1SF, T1SFns, T1DM, T1SLC96, T1C/M1, T1C/M2.
	B8ZS:-	T1ESF, T1ESFns.
	B6ZS:-	T2async, T2sync, 6M/IW.
	CMI:-	140M
BANK	D3/D4	
TX-CLOCK, AIS		
CLOCK	INTERNAL - VARIABLE	
RATE*	704 kbit/s:-	704K.
	256 kbit/s:-	256K
	512 kbit/s:-	512K
	1024 kbit/s:-	1024K
	1544 kbit/s:-	T1SF, T1SFns, T1DM, T1ESF, T1ESFns, T1SLC96.
	2048 kbit/s:-	2M, 2M/noMF, 2M/CRC, 2M/CnoMF, 2M/32Fr.
	3152 kbit/s:-	T1C/M1, T1C/M2.
	6312 kbit/s:-	T2async, T2sync, 6M/IW
	8448 kbit/s:-	8M/742, 8M/745, 8M/744, 8M/741
	34368 kbit/s:-	34M
	139264 kbit/s:-	140M

Parameter	**Option/Value**

PCM Systems (Cont.)

BIT RATE (NON-STD)	Previous setting retained				
OFFSET	0 ppm.				
LEVEL	NORMAL-CABLE SIMULATOR OUT				
AIS	OFF				
AIS ZEROS	NONE				
AIS RATE	1E-6				
TX-PATTERN					
TEST MODE*	FRAMED or TRIB 1 or UNFRAMED (if unframed system selected)				
CHANNEL	1				
N × 64	All channels deselected				
..CARRYING*	PRBS	or	QRSS	or	PRBS
..LENGTH	2^{15}		2^{20}		2^{23}
..0 LIMIT	NONE		14		NONE
..OCTET BITS	ALL 8		ALL8		ALL8
..SENSE	INVERT		TRUE		INVERT
16 BIT WORD	0101010101010101				
DATA CODE	Same as set for Rx				
FILL PATTERN	PRBS				
FILL WORD	01010101				
TX-ERROR INJECTION					
INJECTION	DISABLED				
MODE	MANUAL				
RATE	1E-6				
INJECT..*	BIT ERRORS or BIT ERRORS AFTER CRC				
..	SINGLY				
BURST SIZE	8				
1ST TARGET BIT	FRAMING or PATTERN (if unframed system selected)				
CRC BLOCK ERRORS	Previous setting retained				
TX-SIGNALLING CONTROL*					
MODE	CHANNEL or DTMF				
ACTIVE CHANNEL	1				
CODE IN ACTIVE CHANNEL*	0101 or 01				
CODE IN OTHER CHANNELS*	0101 or 01				
C-BIT SEQUENCE	F11111111111111				
..C-BIT	2				

Parameter	Option/Value

PCM Systems (Cont.)

TX-OVERHEAD BITS*

704K:	TS0:	IFFFFFFF 10011011	INAUUUUU 11011111	MF:	MMMMPLPP 00001011
T1DM:	TS24:	FFFFFYAF 10111110			
T1ESF:	Data Link:	MMMMMMMM 11111111	MMMMMMMM 11111111		
T1ESFns:	Data Link:	MMMMMMMM 11111111	MMMMMMMM 11111111		
T1slc96:	Fs seq:	SSSCC 10100	CAALLLLS 00000000		
2M:	TS0:	IFFFFFFF 10011011	INAUUUUU 11011111	MF:	MMMMPLPP 00001011
2M/noMF:	TS0:	IFFFFFFF 10011011	INAUUUUU 11011111		
2MCRC:	TS0:	IFFFFFFF 0011011	INAUUUUU 1011111	MF:	MMMMPLPP 00001011
2M/CnoMF:	TS0:	IFFFFFFF 0011011	INAUUUUU 1011111		
2M/32Fr:	TS0:	IFFFFFFF 10011011	INAUUUUU 11011111	MF:	MMMMPLPP 00001011
T1C/M2:	YELLOW ALARM:	1			
T2async:	YELLOW ALARM:	1			
T2sync:	YELLOW ALARM:	0			
6M/IW:	YELLOW ALARM:	0			
	Y BIT:	1			
8M/742:	N BIT: A BIT:	1 0			
8M/745:	TS33:	SSSS 1111		TS66:	UUAU 1101
8M/744:		S BIT: 1 A BIT: 0			
8M/741:	TS33:	KKKKKKKK 11111111	TS99: KKKKKKKK 11111111		S BIT: 1 A BIT: 0

MUX 8M :

MUX 34M :

MUX 140M :

Previous settings retained

TX-SEQUENCE TESTS

ERROR 1 FRAME WORDS	READY
ERROR 1 MF WORD	READY
64 kbit/s AIS	READY
TS 16 TO 0	READY
YELLOW ALARM(BIT 2's TO 0)	OFF
ERROR 1 IN 6 140M FRAME WORDS	READY
ERROR 1 IN 6 34M FRAME WORDS	READY
ERROR 1 IN 6 8M FRAME WORDS	READY

Parameter	Option/Value
PCM Systems (Cont.)	
TX-LOOPBACK	
MAKE CODE A	BITS=5 CODE=10000
BREAK CODE A	BITS=3 CODE=100
MAKE CODE B	BITS=4 CODE=1100
BREAK CODE B	BITS=4 CODE=1110
MODE	INACTIVE
TX-MUX CONTROL	Previous settings retained
CONFIGURE-OPTIONS	
VOICE ENCODING	A LAW µ LAW for T1 options

PCM and DATA systems

RX-TEST PATTERN	Previous settings retained if valid
SYNC TO	PRBS or QRSS
SPEAKER	OFF
RX-SIGNALLING MONITOR	Previous settings retained if valid
MODE	SINGLE CHANNEL MONITOR
RX-NETWORK PROP. DELAY	
MODE	READY
TEST-PARAMETERS	
MAJOR ERROR TYPE	PATTERN

DATA systems

TX-SUMMARY	
SYSTEM*	User selected
TEST MODE*	SYNC or UNSTRUCTURED
CODE*	NRZ
CLOCK*	INTERNAL or FROM DCE
BIT RATE*	9.600 kbit/s or 64 kbit/s (CODIR/CONTRA) or 256 kbit/s (EUROCOM)
CLOCK IN	TRUE
CLOCK OUT	TRUE
TX-ASYNC CODING	
DATA BITS	7
PARITY	ODD
STOP BITS	1
CHAR RATE	MEDIUM
TX-PATTERN	
CARRYING	PRBS
..LENGTH	2^{15}
..SENSE	INVERT
MESSAGE	"USER MESSAGE"

Parameter	Option/Value
DATA systems (Cont.)	
TX-ERROR INJECTION	
INJECTION	DISABLED
MODE	MANUAL
RATE	1E-6
1ST TARGET BIT	PATTERN
INJECT*	BIT ERRORS
TX/RX CONTROL LINES	
RTS CONTROL	READY
All control lines OFF except	
DTR	ON (RS-232 DTE)
DSR	ON (RS-232 DCE)

SDATA systems

Structured Data settings are retained if valid when TX-SYSTEM is changed.

PCM+SD mode

In this mode of operation when the SDATA TX-STRUCTURE is changed defaults settings for the SDATA system are:

TX-BITS	
STATUS MODE	UNFRAMED

Default settings when RX-system changed

These are the parameter options and values which the 2851 defaults to if RX-SYSTEM is changed or if the same RX-SYSTEM is re-selected at any time by the user.

Parameter **Option/Value**

PCM systems

Parameter	Option/Value				
RX-SYSTEM					
SYSTEM*	user selected				
ALBO	OUT				
INPUT MODE*	Previous setting retained NRZ if NON STD system selected				
CLOCK	Previous setting retained				
..BIT RATE*	Previous setting retained				
CODE*	Identical to TX				
BANK	D3/D4				
RX-TEST PATTERN					
TEST MODE	FRAMED or TRIB 1 or UNFRAMED (if unframed system selected)				
..CHANNEL	1				
N × 64	All channels deselected				
SYNC TO	PRBS	or	QRSS	OR	PRBS
..LENGTH	2^{15}		2^{20}		2^{23}
..SENSE	INVERT		TRUE		INVERT
..0 LIMIT	NONE		14		NONE
..OCTET BITS	ALL 8		ALL 8		ALL8
..DATA CODE	Same as set for Tx				
..SPEAKER	OFF				

Parameter		Option/Value
PCM Systems (Cont.)		
RX-SIGNALLING MONITOR		
MODE		SINGLE CHANNEL MONITOR
CHANNEL		1
C-BIT		2
RX-LINE LEVEL		
RX INPUT		Previous setting retained
RX-DEMUX CONTROL		Previous settings retained
CONFIGURE-OPTIONS		
VOICE ENCODING*		A LAW μ LAW for T1 options
EXCESS ZEROS		DISABLED

PCM and DATA systems

Parameter		Option/Value
RX-NETWORK PROP. DELAY		
MODE		READY
TX-PATTERN		Previous settings retained if valid
TEST MODE		SINGLE (if D&I no longer valid) or N × 64 (if N × 64 [D&I] no longer valid)
..CARRYING		PRBS or QRSS
TX-SIGNALLING CONTROL		Previous setting retained if valid
MODE		CHANNEL

DATA systems

Parameter		Option/Value
RX-SYSTEM		
SYSTEM*		User selected
INPUT MODE*		TERMINATED if V.11
TEST MODE*		SYNC or UNSTRUCTURED
CODE*		NRZ
CLOCK*		
	FROM DCE:	RS-232 DTE, RS-449 V.10 DTE, RS-449 V.11 DTE, X.21 V.10 DTE, X.21 V.11 DTE V.35 DTE
	FROM DTE:	RS-232 DCE, RS-449 V.10 DCE, RS-449 V.11 DCE, V.35 DCE
	EXTERNAL:	TTL
	FROM TX:	X.21 V.10 DCE, X.21 V.11 DCE
	RECEIVER:	CODIR CONTRA
	EUROCOM:	EUROCOM
..SENSE		TRUE
BIT RATE		9.600 kbit/s or 64 kbit/s (CODIR/CONTRA) or 256 kbit/s (EUROCOM)

Parameter	**Option/Value**
DATA Systems (Cont.)	
RX-TEST PATTERN	
CARRYING	PRBS
..LENGTH	2^{15}
..SENSE	INVERT
MESSAGE	"USER MESSAGE"
RX-ASYNC CODING	
DATA BITS	7
PARITY	ODD
STOP BITS	1

SDATA systems

Structured Data settings are retained if valid when the RX-SYSTEM is changed.

PCM+SD mode

In this mode of operation when the SDATA RX-STRUCTURE is changed defaults settings for the SDATA system are:

RX-BITS	
STATUS MODE	UNFRAMED

Default settings when test mode changed

These are the parameter options and values which the 2851 defaults to if PCM TX or RX-SYSTEM TEST MODE is changed unless in PCM+SD mode.

System	**Selecting TEST MODE**	**forces TX & RX TEST PATTERN to**
704, 2M & 8M	FRAMED, UNFRAMED N X 64, D&I(N) & TRIBn	PRBS, 2^{15}, INVERT, ALL8
704, 2M & 8M	SINGLE, D&I	PRBS, 2^{11}, TRUE, ALL8
T1, T2 & 6M	All Test modes	QRSS

Fixed configuration stores

The Fixed Configuration stores comprise the DEFAULT store and up to 17 other instrument configuration stores (depending on hardware fitted).

Store numbers and titles are as listed below:

DEFAULT Configuration

0 DEFAULT

PCM Configurations

1 140M MULDEX
2 34M MULDEX
3 8M MULDEX
4 140M UNFRAMD
5 34M UNFRAMED
6 8M UNFRAMED
7 T2 UNFRAMED
8 T2ASYNC-FRMD
9 T2SYNC-FRAMD
10 T1C UNFRAMED
11 T1CM2-FRAMED
12 T1CM1-FRAMED
13 2M UNFRAMED
14 2M30-64K CH
15 2M31-64K CH
16 2M30CRC-64K
17 2M31CRC-64K
18 2M30-VF
19 2M31-NX64
20 2M30CRC-VF
21 2M31CRC-NX64
22 2M31-DTMF
23 2M31CRC-DTMF
24 2M30-DTMF
25 2M30CRC-DTMF
26 T1 UNFRAMED
27 T1NOSIG-NX64
28 T1ESFNOSIGNX
29 T1NOSIG-64K
30 T1ESFNOSIG64
31 T1 SIG-VF
32 T1ESF SIG-VF
33 T1DM-64K
34 704K UNFRMD
35 704K-64K CH
36 704K-NX64
37 EURO IB5 256

DATA Configurations

38 X21-V11-DTE
39 RS449-V11DTE
40 V35-DTE
41 RS232-DTE
42 CODIRECTIONL
43 CONTRADIRNL
44 EURO IB6 256
45 SPARE

SDATA Configurations

46 X50-CODIR
47 X50-V11

Configurations PCM+SD

48 X50-2M31
49 X50-2M31CRC

Default settings when Default store is recalled

These are the parameter options and values which the 2851 defaults to if the DEFAULT store is recalled.

The default settings are identical to the defaults as listed for when Tx-System and Rx-Systems are changed but with TX/RX-SYSTEM set for:

PCM to 2M (RX cards AD11, AD98, AD99) or T1SF (RX card AD12)

DATA to RS-232 DTE and for

SDATA to as displayed

plus the following:-

Parameter	Option/Value	
TEST-PARAMETERS		
TERMINATION	INDEFINITE	
TERMINATE AFTER	00:10:00	
BUZZER	DISABLED	
GATING	1 SEC	
MAJOR ERROR TYPE	FRAME WORD or FRAME BIT	
BURST THRESH	8	
TEST-STORED G.821 SETUP		
INTERVAL	24 HOURS	
STORED INTERVALS	30	
TEST-STORED G.821 LIMITS		
LIMITS TYPE	G821	
LOCAL GRADE	1250 km	
MEDIUM GRADE	1250 km	
MEDIUM GRADE RADIO	0 km	
HIGH GRADE	25000 km	
HIGH GRADE RADIO	0 km	
CLASS 1	2500 km	
CLASS 1 RADIO	0 km	
CLASS 2	2500 km	
CLASS 2 RADIO	0 km	
CLASS 3	500 km	
CLASS 3 RADIO	0 km	
CLASS 4	500 km	
CLASS 4 RADIO	0 km	
DM PERIOD LIMIT	30.000	
ES PERIOD LIMIT	300.000	
SES PERIOD LIMIT	300.000	
TEST-PERF-LIMITS		
G.821 %ES LIMIT	99.9999	OFF
G.821 %SES LIMIT	99.9999	OFF
G.821 %DM LIMIT	99.9999	OFF
G.821 %US LIMIT	99.9999	OFF
G.826 ESR LIMIT	9999	OFF
G.826 SESR LIMIT	9999	OFF
G.826 BBER LIMIT	9999	OFF
G.826 %US LIMIT	99.9999	OFF
M.2100 ES S1 LIMIT	9998	OFF
M.2100 ES S2 LIMIT	9999	OFF
M.2100 SES S1 LIMIT	9998	OFF
M.2100 SES S2 LIMIT	9999	OFF
M.2100 US S1 LIMIT	9998	OFF
M.2100 US S2 LIMIT	9999	OFF
FORWARD PATH		OFF

Parameter	Option/Value
CONFIGURE-SIGNALLING	
PULSE BREAK MIN	50ms
PULSE BREAK MAX	100ms
INTER-PULSE BREAK MIN	25ms
INTER-PULSE BREAK MAX	50ms
INTER-DIGIT PAUSE MIN	400ms
PULSE BREAK CODE	0000
INTER-PULSE BREAK CODE	0000
DIAL MAPPING	1-9,0
CONFIGURE-EVENT PRINT	
EVENT PRINT	OFF
ON ALARM CHANGE	NO
ON ERRORED SECOND	NO
ON SIGNALLING/ISDN CHANGE	NO
ON CROSSING THRESHOLD	NO
THRESHOLD	1E-6
CONFIGURE-INTERVAL PRINT	
INTERVAL PRINT	OFF
INTERVAL	15 min
INCLUDE MAJOR ERRORS	NO
INCLUDE OTHER ERRORS	NO
INCLUDE PERFORMANCE G.821	NO
INCLUDE PERFORMANCE G.826	NO
INCLUDE STORED RESULTS	NO
INCLUDE SYNC SLIPS	NO
CONFIGURE-PRINTER	
ID NO.	0
LABEL	2851

PCM & DATA TX

Parameter	Option/Value
TX-SUMMARY (NON-STD)	
BIT RATE	2048 kbit/s:- AD11, AD99 1544 kbit/s:- AD12
TX-SIGNALLING CONTROL (DTMF)	
DIALLING MODE	DIAL
TONE ON/OFF	50/50 ms
PULSE DURATION	500 ms
TX-MUX CONTROL	
MUX	OFF
CODE	HDB3 (2852(S)/2853(S)) or CMI (2854S/2855S)
FROM	2M
..TO	34M (2852(S)/2853(S)) or 140M (2854S/2855S)
CLOCK	INTERNAL
..OFFSET	0 ppm
34M TRIB	1
FILL PATTERN	ALL 1
8M TRIB	1
FILL PATTERN	ALL 1
2M TRIB	1
FILL PATTERN	ALL 1

Parameter	Option/Value
PCM & DATA RX	
RX-SYSTEM	
INPUT MODE	BRIDGING or NRZ (no RX card)
RX-SYSTEM (NON STD)	
CLOCK	EXTERNAL TTL
BIT RATE	2048 kbit/s:- AD11, AD99 1544 kbit/s:- AD12
RX-LINE LEVEL	
RX INPUT	UNBALANCED
RX-SIGNALLING MONITOR	
IDLE CODE*	1111
RX-DEMUX CONTROL	
DEMUX	OFF
FROM	34M (2852(S)/2853(S)) or 140M (2854S/2855S)
..TO	2M
34M TRIB	1
8M TRIB	1
2M TRIB	1
INPUT MODE	BRIDGING
CODE	HDB3 (2852(S)/2853(S)) or CMI (2854S/2855S)
SDATA TX	
TX-SUMMARY	
INTERFACE	BAL 120 if fitted otherwise TTL or V.11
LINE CODE	CODIR
STRUCTURE	X.50 20
BIT RATE	64.000 kbit/s
..+/-	0
D & I	OFF
INTERFACE IN	BAL 120 if fitted otherwise TTL or V.11
LINE CODE IN	CODIR
TX-CLOCK	
CLOCK SOURCE	INTERNAL
..POLARITY	TRUE
ALIGNMENT LOCK	OFF
CLOCK OUTPUT	NONE
..POLARITY	TRUE
TX-PATTERN	
CARRYING	PRBS 2^15
..SENSE	INVERT
..n	6-BIT WORD
..WORD VALUE	010101
FILL PATTERN	PRBS 2^7
FILL STATUS	0
TX-DATA RATE	
DATA RATE	48.0 kbit/s
CHANNEL	1
CHANNELS	1 & 2

Parameter	Option/Value
SDATA TX (Cont.)	
TX-BITS	
STATUS MODE	UNFRAMED
..	OBSERVATION
..BITS	0000000
HOUSEKEEPING BITS (20)	1
HOUSEKEEPING BITS (80)	A:1 B:1 C:1 D:0 E:0 F:1 G:1 H:0
TX-ERROR INJECTION	
INJECTION	DISABLED
RATE	MANUAL
TARGET	PATTERN
..INTO BIT	1
TX-AIS, LEVELS	
OUTPUTS LEVEL	1.00 V
AIS INJECT	READY
AIS INJECT LENGTH	0.01 sec

SDATA RX

Parameter	Option/Value
RX-SYSTEM	
INTERFACE	BAL 120 if fitted otherwise TTL or V.11
INPUT	TERMINATED
LINE CODE	CODIR
STRUCTURE	X.50 20
BIT RATE	64.000 kbit/s
RX-CLOCK	
TIMING SOURCE	RECEIVER
..POLARITY	TRUE
TIMING OUTPUT	NONE
..POLARITY	TRUE
ALIGNMENT LOCK	OFF
RX-PATTERN	
SYNC TO	PRBS 2^15
..SENSE	INVERT
..WORD VALUE	010101
..N	6 BIT WORD
RX-DATA RATE	
DATA RATE	48.0 kbits
CHANNEL	1
CHANNELS	1 & 2
RX-BITS	
STATUS MODE	UNFRAMED
RX-LEVELS	
INPUTS LEVEL	0.5 V

Default settings when a Fixed Configuration store is recalled

The default settings are identical to the DEFAULT store configurations but with the following variations:

Parameter	Option/Value

PCM Configurations

1. 140M MULDEX : as 2M plus ...

TX-SUMMARY,TEST MODE	NX64
TX-PATTERN,Nx64	Channel 1 selected
TX-MUX CONTROL,MUX	ON
TX-MUX CONTROL,CODE	CMI
TX-MUX CONTROL,TO	140M
TX-MUX CONTROL, 34M FILL PATTERN	PRBS
TX-MUX CONTROL, 8M FILL PATTERN	PRBS
TX-MUX CONTROL, 2M FILL PATTERN	PRBS
TX-ERROR INJECTION, IST TARGET BIT	2M FRAMING
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	NX64
RX-TEST PATTERN,Nx64	Channel 1 selected
RX-DEMUX CONTROL,DEMUX	ON
RX-DEMUX CONTROL,FROM	140M
RX-DEMUX CONTROL,INPUT MODE	MON 20
RX-DEMUX CONTROL,CODE	CMI
TEST-PARAMETERS,MAJOR ERROR TYPE	2M FRAME WORD

2. 34M MULDEX : as 2M plus ...

TX-SUMMARY,TEST MODE	NX64
TX-PATTERN,Nx64	Channel 1 selected
TX-MUX CONTROL,MUX	ON
TX-MUX CONTROL, 34M FILL PATTERN	PRBS
TX-MUX CONTROL, 8M FILL PATTERN	PRBS
TX-MUX CONTROL, 2M FILL PATTERN	PRBS
RX-SYSTEM,INPUT MODE	TERMINATED
TX-ERROR INJECTION, IST TARGET BIT	2M FRAMING
RX-TEST PATTERN,TEST MODE	NX64
RX-TEST PATTERN,Nx64	Channel 1 selected
RX-DEMUX CONTROL,DEMUX	ON
RX-DEMUX CONTROL,INPUT MODE	MON 26
TEST-PARAMETERS,MAJOR ERROR TYPE	2M FRAME WORD

Parameter	Option/Value
PCM configurations (Cont.)	
3. 8M MULDEX : as 2M plus ...	
TX-SUMMARY,TEST MODE	NX64
TX-PATTERN,Nx64	Channel 1 selected
TX-MUX CONTROL,MUX	ON
TX-MUX CONTROL,TO	8M
TX-MUX CONTROL, 34M FILL PATTERN	PRBS
TX-MUX CONTROL, 8M FILL PATTERN	PRBS
TX-MUX CONTROL, 2M FILL PATTERN	PRBS
TX-ERROR INJECTION, IST TARGET BIT	2M FRAMING
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	NX64
RX-TEST PATTERN,Nx64	Channel 1 selected
RX-DEMUX CONTROL,DEMUX	ON
RX-DEMUX CONTROL,FROM	8M
RX-DEMUX CONTROL,INPUT MODE	MON 20
TEST-PARAMETERS,MAJOR ERROR TYPE	2M FRAME WORD
4. 140M UNFRAMED : as 140M plus ...	
5. 34M UNFRAMED : as 34M plus ...	
TX-SUMMARY,TEST MODE	UNFRAMED
TX-PATTERN,LENGTH	2^23
TX-PATTERN,SENSE	INVERT
TX-ERROR INJECTION,1ST TARGET BIT	PATTERN
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	UNFRAMED
RX-TEST PATTERN,LENGTH	2^23
RX-TEST PATTERN,SENSE	INVERT
TEST-PARAMETERS,MAJOR ERROR TYPE	PATTERN

Parameter	Option/Value
PCM configurations (Cont.)	
6. 8M UNFRAMED : as 8M742 plus ...	
13. 2M UNFRAMED : as 2M plus ...	
34. 704K UNFRAMD : as 704K plus ...	
37. EURO IB5 256 : as 256K plus ...	
TX-SUMMARY,TEST MODE	UNFRAMED
TX-PATTERN,LENGTH	2^15
TX-PATTERN,SENSE	INVERT
TX-ERROR INJECTION,1ST TARGET BIT	PATTERN
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	UNFRAMED
RX-TEST PATTERN,LENGTH	2^15
RX-TEST PATTERN,SENSE	INVERT
TEST-PARAMETERS,MAJOR ERROR TYPE	PATTERN
9. T2SYNC-FRAMD : as T2SYNC plus ...	
TX-SUMMARY,TEST MODE	FRAMED
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	FRAMED
TEST-PARAMETERS,MAJOR ERROR TYPE	FRAME WORD
8. T2ASYNC-FRMD : as T2ASYNC plus ...	
11. T1CM2-FRAMED : as T1CM2 plus ...	
12. T1CM1-FRAMED : as T1CM1 plus ...	
TX-SUMMARY,TEST MODE	TRIB 1
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	TRIB 1
TEST-PARAMETERS,MAJOR ERROR TYPE	FRAME WORD
14. 2M30-64K CH : as 2M plus ...	
15. 2M31-64K CH : as 2MNOMF plus ...	
16. 2M30CRC-64K : as 2MCRC plus ...	
17. 2M31CRC-64K : as 2MCNOMF plus ...	
29. T1NOSIG-64K : as T1SFNS plus ...	
30. T1ESFNOSIG64 : as T1ESFNS plus ...	
33. T1DM-64K : as T1DM plus ...	

Parameter	Option/Value
PCM configurations (Cont.)	
35. 704K-64K CH : as 704K plus ...	
TX-SUMMARY,TEST MODE	FRAMED SINGLE CHANNEL
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	FRAMED SINGLE CHANNEL
TEST-PARAMETERS,MAJOR ERROR TYPE	PATTERN
18. 2M30-VF : as 2M plus ...	
20. 2M30CRC-VF : as 2MCRC plus ...	
22. 2M31-DTMF : as 2MNOMF plus ...	
23. 2M31CRC-DTMF : as 2MCNOMF plus ...	
24. 2M30-DTMF : as 2M plus ...	
25. 2M30CRC-DTMF : as 2MCRC plus ...	
31. T1 SIG-VF : as T1SF plus ...	
32. T1ESF SIG-VF : as T1ESF plus ...	
TX-SUMMARY,TEST MODE	FRAMED SINGLE CHANNEL
TX-PATTERN,CARRYING	VOICE
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	FRAMED SINGLE CHANNEL
RX-TEST PATTERN,SYNC TO	VOICE
RX-TEST PATTERN,SPEAKER	ON
TEST-PARAMETERS,MAJOR ERROR TYPE	PATTERN
19. 2M31-NX64 : as 2MNOMF plus ...	
21. 2M31CRC-NX64 : as 2MCNOMF plus ...	
27. T1NOSIG-NX64 : as T1SFNS plus ...	
28. T1ESFNOSIGNX : as T1ESFNS plus ...	
36. 704K-NX64 : as 704K plus ...	
TX-SUMMARY,TEST MODE NX64	
TX-PATTERN,Nx64	Channel 1 selected
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	NX64
RX-TEST PATTERN,Nx64	Channel 1 selected
TEST-PARAMETERS,MAJOR ERROR TYPE	PATTERN

Parameter	Option/Value
PCM configurations (Cont.)	
10. T1C UNFRAMED : as T1CM2 plus ...	
26. T1 UNFRAMED : as T1SFNS plus ...	
7. T2 UNFRAMED : as T2ASYNC plus ...	
TX-SUMMARY,TEST MODE	UNFRAMED
TX-ERROR INJECTION,1ST TARGET BIT	PATTERN
RX-SYSTEM,INPUT MODE	TERMINATED
RX-TEST PATTERN,TEST MODE	UNFRAMED
TEST-PARAMETERS,MAJOR ERROR TYPE	PATTERN

DATA Configurations

38. X21-V11-DTE : as X.21 V.11 DTE

39. RS449-V11DTE : as RS-449 V.11 DTE

40. V35-DTE : as V.35 DTE

41. RS232-DTE : as RS-232 DTE

42. CODIRECTIONL : as CODIR

43. CONTRADIRNL : as CONTRA

44. EURO IB6 256 : as EUROCOM

SDATA Configurations

46. X50-CODIR :	
TX-SUMMARY,INTERFACE	BAL 120
TX_SUMMARY,LINE CODE	CO-DIR
RX-SYSTEM,INTERFACE	BAL 120
RX-SYSTEM,LINE CODE	CO-DIR
TEST-PARAMETERS,MAJOR ERROR TYPE	SDATA PATTERN
(TX-SUMMARY,SYSTEM [PCM mode]	previous setting retained)
(TX-SUMMARY,SYSTEM [DATA mode]	previous setting retained)
(RX-SYSTEM,SYSTEM [PCM mode]	previous setting retained)
(RX-SYSTEM,INPUT MODE [PCM mode]	TERMINATED)
(RX-SYSTEM,SYSTEM [DATA mode]	previous setting retained)
47. X50-V11 :	
TX-SUMMARY,INTERFACE	BAL V11
TX_SUMMARY,LINE CODE	NRZ
RX-SYSTEM,INTERFACE	BAL V11
RX-SYSTEM,LINE CODE	NRZ

Parameter	Option/Value
SDATA X.50 V11 configurations (Cont.)	
TEST-PARAMETERS,MAJOR ERROR TYPE	SDATA PATTERN
(TX-SUMMARY,SYSTEM [PCM mode]	previous setting retained)
(TX-SUMMARY,SYSTEM [DATA mode]	previous setting retained)
(RX-SYSTEM, SYSTEM [PCM mode]	previous setting retained)
(RX-SYSTEM,INPUT MODE [PCM mode]	TERMINATED)
(RX-SYSTEM,SYSTEM [DATA mode]	previous setting retained)

PCM+SD Configurations

48. X50-2M31 :
[PCM Menu]

TX-SUMMARY,SYSTEM	2MNOMF
TX-SUMMARY,TEST MODE	FRAMED SINGLE CHANNEL
TX-PATTERN,CARRYING	STRUCTURED DATA
RX-SYSTEM,SYSTEM	2MNOMF
RX-SYSTEM,INPUT MODE	TERMINATED
RX-SYSTEM,TEST MODE	FRAMED SINGLE CHANNEL
RX-TEST PATTERN,SYNC TO	STRUCTURED DATA
TEST-PARAMETERS,MAJOR ERROR TYPE	SDATA PATTERN

[SDATA Menu]

TX-SUMMARY,INTERFACE	PCM CH
TX-SUMMARY,STRUCTURE	X50 80
RX-SYSTEM,INTERFACE	PCM CH
RX-SYSTEM,STRUCTURE	X50 80
(TX-SUMMARY,SYSTEM [DATA mode]	previous setting retained)
(RX-SYSTEM,SYSTEM [DATA mode]	Previous setting retained)

49. X50-2M31CRC :
[PCM Menu]

TX-SUMMARY,SYSTEM	2MCNOMF
TX-SUMMARY,TEST MODE	FRAMED SINGLE CHANNEL
TX-PATTERN,CARRYING	STRUCTURED DATA
RX-SYSTEM,SYSTEM	2MCNOMF
RX-SYSTEM,INPUT MODE	TERMINATED
RX-SYSTEM,TEST MODE	FRAMED SINGLE CHANNEL
RX-TEST PATTERN,SYNC TO	STRUCTURED DATA
TEST-PARAMETERS,MAJOR ERROR TYPE	SDATA PATTERN

Parameter	Option/Value
PCM+SD configurations (Cont.)	
[SDATA Menu]	
TX-SUMMARY,INTERFACE	PCM CH
TX-SUMMARY,STRUCTURE	X50 80
RX-SYSTEM,INTERFACE	PCM CH
RX-SYSTEM,STRUCTURE	X50 80
(TX-SUMMARY,SYSTEM [DATA mode]	previous setting retained)
(RX-SYSTEM,SYSTEM [DATA mode]	previous setting retained)

Default settings when self-test fails

These are the parameter options and values which the 2851 defaults to if a failure occurs during the self-test performed on power-up.

The default settings are identical to the defaults for when the DEFAULT store is recalled plus the following:-

Parameter	Option/Value
CONFIGURE-PORT	
RS-232	
USED FOR	REMOTE
BAUD RATE	300
FORMAT	7O1
HANDSHAKE	HARDWARE & SOFTWARE
GPIB	
USED FOR	PRINTER
MODE	LISTEN ONLY
ADDRESS	4
CONFIGURE-PRINTER	
TYPE	TEXT ONLY
..TERMINATOR	CR + LF
TX-SIGNALLING CONTROL	
DIAL NUMBER	0438742200
TX-ERROR INJECTION	
CRC BLOCK ERROR RATE	ES
USER ERROR RATE	10 BLOCKS IN 1000
ES ERROR RATE	1 BLOCK IN 1000
SES ERROR RATE	831 BLOCKS IN 1000
DM ERROR RATE	123 BLOCKS IN 60 000
RESULTS-PERFORMANCE	
NOMINAL	100% = GOOD
CONFIGURE-OPTIONS	
AUTO-SKIP CURSOR	DISABLED
LANGUAGE	default to language for instrument
VOICE ENCODING	A-LAW µ LAW for T1 options
ERRORS LED THRESHOLD	1E-9

Appendix B
DISPLAY MESSAGES

A message can appear at the top line on the right of a page and on the bottom line of a page.

A top line message indicates the current instrument status e.g. TEST RUNNING or IN REMOTE. A top line message is displayed continuously unless more than one condition is active in which case each message is alternately displayed at one second intervals.

A bottom line message indicates a condition in response to a particular attempted keyboard entry e.g. 'Value out of range' or confirmation that a keyboard short cut operation has been completed e.g. 'Transmitter turned ON'. A bottom line message is displayed for approximately one second replacing any softkey options previously displayed.

Top line messages

C-BIT : UNSYNC

Indicates C-bit framing is not correct.

DROP & INSERT

Indicates the 2851 is set to Drop and Insert mode.

G.821 > LIMIT

Indicates a G.821 parameter has exceeded the specified limit.

G.826 > LIMIT

Indicates a G.826 parameter has exceeded the specified limit.

M.2100 > LIMIT

Indicates an M.2100 parameter has exceeded the specified limit.

IN REMOTE

Indicates the 2851 is set to remote operation.

KEYBD LOCKED

Indicates the keyboard is locked.

LOOP ACTIVE

Indicates a remote loopback has been made.

LOOPBACK A SET

Indicates Transmitter has sent a loopback Make code A.

LOOPBACK B SET

Indicates Transmitter has sent a loopback Make code B.

NPD RUNNING

Indicates Receiver is in Network Propagation Delay measurement mode.

PRINT RAM FULL

Indicates there is no space in RAM for further autoprint texts.

PRINT STORE

Indicates autoprint texts in RAM have not been stored.

RECALLED TESTS

Indicates displayed test results have been recalled from store.

RX : CRC UNSYNC

Indicates Receiver has lost CRC synchronization.

RX : DEMUX ON

Indicates Receiver demultiplex operation has been selected.

TEST RUNNING

Indicates test in progress.

TEST STORE

Indicates latest test results have not been stored.

TX : AIS

Indicates Transmitter is sending the Alarm Indication Signal.

TX : MUX ON

Indicates Transmitter multiplex operation has been selected.

TX : NO CLOCK

Indicates the selected clock is not present. If external clock is selected, check external signal. If Internal clock is selected, the 2851 is likely to be faulty.

TX : OFF

Indicates the 2851 Transmitter is switched off.

Bottom line messages

Checksums failed - defaults re-loaded

Checksum test failed on power-up.

Sets the default instrument settings.

Hardware changed - defaults re-loaded

Hardware options changed at power-down.

Sets the default instrument settings on power-up.

Internal Error : nn

A serious error has occurred, contact IFR Service Division.

Invalid Syntax or Value out of range

Attempted to enter data outside the specification limits or used invalid syntax. See Editing Procedures.

Keyboard locked

Keyboard is now locked. The top line message KEYBD LOCKED is always displayed when the keyboard is locked.

Keyboard unlocked

Keyboard is now unlocked. The top line message KEYBD LOCKED is always displayed when the keyboard is locked.

Not Stored - Directory or Memory Full . . .

The maximum number of tests have already been stored.

Operation invalid for this configuration

Attempted to select a keyboard shortcut which is not available with the current configuration.

Page invalid

Attempted to select a page using the LAST PAGE key which is not now available.

Page invalid for this configuration

Attempted to select a page which is no longer available with the current configuration.

Recalling Configuration . . .

Indicates a stored set of instrument settings are being recalled.

Recalling Store . . .

Indicates a stored set of test results is being recalled.

Serial Port Framing Error

Serial port I/O interface has detected a framing error. Check CONFIGURE-PORT page parameters are correct.

Serial Port Overrun Error

Serial port I/O interface has detected an overrun error. Check CONFIGURE-PORT page parameters are correct.

Serial Port Parity Error

Serial port I/O interface has detected a parity error. Check CONFIGURE-PORT page parameters are correct.

Serial Port Timeout

Serial port I/O interface has timed out. Check connected device is switched on and set-up correctly.

Set error control to MANUAL and ENABLED

Attempted to inject an error by key press in the TX-ERROR INJECTION page without first setting INJECTION to ENABLED and MODE to MANUAL.

Set Rx to SINGLE and VOICE

Attempted to change buzzer setting using keyboard short cut whilst buzzer not available.

Test already running

Pressed START key while test was running.

Test already stopped

Pressed STOP key after test had stopped.

Test NOT started. Rx Nx64 has N=0

Attempted to start test with Rx mode set to Nx64 and no channels selected (N=0).

Test NOT started. Data cable mismatch

Data cable connected is not compatible with the selected data test interface.

Value set to maximum limit

Attempted to enter a value outside the parameter specification maximum limit. Sets the value to the maximum limit value.

Value set to minimum limit

Attempted to enter a value outside the parameter specification minimum limit. Sets the value to the minimum limit value.

Software reset - defaults re-loaded

Software has been changed and instrument has automatically reloaded defaults (Message displayed at first power up after change).

Disallowed fields

Changes to some options are inhibited because of prevailing operating conditions, e.g. a Test is still in progress. A message explaining why the option is not available is displayed on the bottom line.

Messages:

Change not allowed if Test in progress
Change not allowed if Tx off
Change not allowed if Tx on
Change not allowed in this configuration
Demux not allowed in this configuration
Mux not allowed in this configuration
RECALL not allowed if Test in progress
RECALL not allowed, H/W not available
STORE not allowed if Test in progress

Keyboard shortcut confirmations

Messages:

AIS turned OFF
AIS turned ON
Buzzer disabled
Buzzer Restored to ALARMS
Buzzer Restored to BOTH
Buzzer Restored to ERRORS
Demux turned OFF
Demux turned ON

Error injection disabled
Error injection enabled
Event print turned OFF
Event print turned ON
Interval print turned OFF
Interval print turned ON
Mux turned OFF
Mux turned ON
RX speaker turned OFF
RX speaker turned ON
Transmitter turned OFF
Transmitter turned ON
Volume setting (1-16) : nn

Remote errors

The following messages are displayed in response to errors occurring when the 2851 is under Remote control. For further information refer to Chap. 4.

Remote - QUERY error : nn

0 = No error
1 = Interrupted i.e. a new Read command was sent before 2851 &2851S finished replying.
2 = Unterminated i.e. Read command was sent without termination.
3 = Deadlocked i.e. both the Rx and Tx buffers were full.

Remote - COMMAND error : nn

0 = No error
1 = Illegal *Command
2 = Parameter not allowed
3 = Unrecognised command mnemonic
4 = Command mnemonic not unique
5 = Option/Value not allowed with write command
6 = Read not allowed with command mnemonic
7 = Parser error

Remote - DEVICE error : nn

0 = No error
1 = Value out of range
2 = Unable to change to new Option/Value
3 = Bar graph cursor out of range
4 = Page invalid on current settings
5 = Parameter unavailable or Option/Value not compatible with selected parameter.
6 = Command unavailable on current instrument selections (software/hardware).
7 = Macro in use.

Remote - EXECUTION error : nn

0 = No error
1 = Numerical value/option data not allowed
2 = Excess data
3 = Insufficient data
4 = Data is required
5 = Unrecognised Option/Value alpha text
6 = Option/Value alpha text not unique
7 = Unrecognised suffix
8 = Suffix not allowed

Appendix C
DESCRIPTION AND 2851 CAPABILITY OF EACH FRAMING SYSTEM

This appendix gives further details about the framing systems that the 2851 is capable of transmitting and receiving.

It is organised such that for each framing system a description of the frame format is detailed, followed by the 2851 transmit capability and the receive capability. Note that the description is of the 'proper' framing system. The Rx & Tx sections detail our divergence from the standards.

The framing systems covered are:-

Summary of framing systems

FRAMING SYSTEMS	704K	T1SF	T1SF ns	T1DM	T1 ESF	T1ES Fns	T1 slc	2M
PATTERN INTO CHAN	10	24	24	23	24	24	24	30
INTO TRIB	-	-	-	-	-	-	-	-
DATA INTO CHAN	10	24	24	23	24	24	24	30
VOICE INTO CHAN	-	24	24	23	24	24	24	30
SIGNALLING	yes	yes	no	no	yes	no	yes	yes
NORMAL LINE CODE	HDB3	AMI	AMI	AMI	B8ZS	B8ZS	AMI	HDB3
AIS,FRAME,ERRORS	yes	yes	yes	yes	yes	yes	yes	yes
MULTIFRAME	yes	-	-	-	-	-	-	yes
DISTANT	yes	-	-	-	-	-	-	yes
DISTANT MF	yes	-	-	-	-	-	-	yes
EXCESS ZEROS	-	yes	yes	yes	yes	yes	yes	-
YELLOW	-	yes	yes	yes	yes	yes	yes	-
64K AIS	-	-	-	-	-	-	-	yes
CRC MF	-	-	-	-	-	-	-	-
BURST WINDOW LENGTH (FRAMES)	16	12	12	12	24	24	72	16

64K AIS information only available remotely/on autoprint.

FRAMING SYSTEMS	2M noMF	2M CRC	2M C/noMF	2M 32Fr	T1C M1	T1C M2	T2 async	T2 sync
PATTERN INTO CHAN	31	30	31	30	-	-	-	96
INTO TRIB	-	-	-	-	2	2	4	-
DATA INTO CHAN	31	30	31	30	-	-	-	96
VOICE INTO CHAN	31	30	31	30	-	-	-	-
SIGNALLING	no	yes	no	yes	no	no	no	no
NORMAL LINE CODE	HDB3	HDB3	HDB3	HDB3	AMI	AMI	B6ZS	B6ZS
AIS,FRAME,ERRORS	yes	yes	yes	yes	yes	yes	yes	yes
MULTIFRAME	-	yes	-	yes	-	-	-	-
DISTANT	yes	yes	yes	yes	-	-	-	-
DISTANT MF	-	yes	-	yes	-	-	-	-
EXCESS ZEROS	-	-	-	-	yes	yes	yes	yes
YELLOW	-	-	-	-	-	yes	yes	yes
64K AIS	-	yes	-	yes	-	-	-	-
CRC MF	-	yes	yes	-	-	-	-	-
BURST WINDOW LENGTH (FRAMES)	16	16	16	32	16	16	32	16

64K AIS information only available remotely/on autoprint.

FRAMING SYSTEMS	6M IW	8M 742	8M 745	8M 744	8M 741	34M 751	140M 751
PATTERN INTO CHAN	-	-	-	120*	-	-	-
INTO TRIB	3	4	4	-	4	4	4
DATA INTO CHAN	-	-	-	120*	-	-	-
VOICE INTO CHAN	-	-	-	-	-	-	-
SIGNALLING	no	no	no	no	no	no	no
NORMAL LINE CODE	B6ZS	HDB3	HDB3	HDB3	HDB3	HDB3	CMI
AIS,FRAME,ERRORS	yes	yes	yes	yes	yes	yes	yes
MULTIFRAME	-	-	-	yes	-	-	-
DISTANT	-	yes	yes	yes	yes	yes	yes
DISTANT MF	-	-	-	-	-	-	-
EXCESS ZEROS	yes	-	-	-	-	-	-
YELLOW	yes	-	-	-	-	-	-
64K AIS	-	-	-	-	-	-	-
CRC MF	-	-	-	-	-	-	-
BURST WINDOW LENGTH (FRAMES)	16	16	16	16	16	-	-

120* Actually 125, see section 8M/744 page C-37.
64K AIS information only available remotely/on autoprint.

704kbit/s 10 channel system "704K"

Description

704kbit/s	Bits per Frame	: 88
10 * 64K channels	Frames per Multiframe	: 16 (0 to 15)
Normal Line Code : HDB3	Bits per Multiframe	: 1408

	Time-slot 0	
Frame 0	I 0 0 1 1 0 1 1	10 * DDDDDDDD
Frame 1	S S S S S S S S	10 * DDDDDDDD
Frame 2	I 1 A U U U U U	10 * DDDDDDDD
Frame 3	S S S S S S S S	10 * DDDDDDDD
etc.		Chan. 1-10
OR	Time-slot 0	
Frame 0	I 1 A U U U U U	10 * DDDDDDDD
Frame 1	S S S S S S S S	10 * DDDDDDDD
Frame 2	I 0 0 1 1 0 1 1	10 * DDDDDDDD
Frame 3	S S S S S S S S	10 * DDDDDDDD
etc.		Chan. 1-10

Signalling (Channel Associated) (S bit) Pattern:-

0 0 0 0	P L P P	in frame 1
(a b c d..for chan 1)	(a b c d..for chan 2)	in frame 3
(a b c d..for chan 3)	(a b c d..for chan 4)	in frame 5
(a b c d..for chan 5)	(a b c d..for chan 6)	in frame 7
(a b c d..for chan 7)	(a b c d..for chan 8)	in frame 9
(a b c d..for chan 9)	(a b c d..for chan 10)	in frame 11
N N N N	N N N N	in frames 13,15

Where 0 0 1 1 0 1 1 is the Frame Alignment Signal (FAS).
0 0 0 0 is the Multiframe Alignment Signal Word.

I	=	International Service Bits (Normally 1).
A	=	Distant/Remote Alarm (1 = Alarm).
U	=	Unassigned/Spare Frame Bits (Normally 1).
L	=	Distant Multiframe Alarm Bit (1 = Alarm).
P	=	Unassigned/Spare Multiframe Bits (Normally 1).
D	=	Data bit.
N	=	National bits (arbitrarily set/fixed to all ones in transmitter).
abcd	=	Channel Signalling Code.

TX capability

Note

Frames 2, 6, 10 & 14 will contain the FAS.
Frame 1 will contain the Multiframe Alignment Word.

Data:

D bits may be a complete pattern or may be 1 channel of test/9 channels of fill/Receiver pattern. 1 channel data may be internal patterns or external data.

Bit control:

The following bits may be controlled:-

The 2 I bits.
The A (Distant) Alarm bit.
The U (Unassigned not frame) bits.
The L (DMF) bit.
The P (Unassigned MF) bits.
The not frame bit (bit 2 in not FAS).

704kbit/s 10 channel system "704K" (continued)

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive FAS
Error 1, 2, 3 or ALL successive Multiframe Alignment Words.

Signalling control:

A 4 bit code may be set for a selected channel.
A 4 bit code may be set for all other channels.

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
MULTIFRAME	:	Loss of Multiframe Alignment.
DISTANT	:	Monitored A bit.
DISTANT MF	:	Monitored L bit.

Frame Sync Conditions	:	Correct FAW, NFAW(bit 2), FAW sequence.
..Loss Conditions	:	3 FAWs in error.
Multiframe Sync	:	MFAW correct.
..Loss Conditions	:	2 MFAWs in error.

Data:

All D bits may be the pattern or the pattern may be in one channel only.
1 channel data may be internal patterns or external data.

Bit monitoring:

The following bits are monitored:-

The 2 I bits.
The U (Unassigned not frame) bits.
The P (unassigned multiframe) bits.
The not frame bit (bit 2 in not FAS).

Signalling:

A selected channels signalling is analyzed against user entered masks.

T1 superframe format - "T1SF"

Description

1544kbit/s	Bits per Frame	: 193
24 * 64K (56K) channels	Frames per Superframe	: 12 (1 to 12)
Normal Line Code : AMI	Bits per Superframe	: 2316

```
      bit1          bit8
F....24 * DDDDDDDD   in frames 1 to 5 & 7 to 11
F....24 * DDDDDDDa   in frame 6
F....24 * DDDDDDDb   in frame 12

1   0   0   0   1   1   0   1   1   1   0   0
Ft  Fs  Ft  Fs  Ft  Fs  Ft  Fs  Ft  Fs  Ft  Fs
```

Where Ft bits 1 0 1 0 1 0 are the terminal framing bits.
Fs bits 0 0 1 1 1 0 are the signalling framing bits.
D = Data bit.
a = signalling channel a bit.
b = signalling channel b bit.

T1 Channel Assignments with Different Channel Banks - (Bell PUB 43801)
Time Slot Order:-

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
D3/D4 :	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
D2 :	12	13	1	17	5	21	9	15	3	19	7	23	11	14	2	18	6	22	10	16	4	20	8	24
D1D :	1	13	2	14	3	15	4	16	5	17	6	18	7	19	8	20	9	21	10	22	11	23	12	24

Note **For the purposes of error injection and monitoring, Ft and Fs bits are framing bits.**

TX capability

Note **Frame 12 will carry the last Fs bit.**

Data:

D bits may be a complete pattern or may be 1 channel of test/23 channels of fill/Receiver pattern.
1 channel data may be internal patterns, external data or external voice.

Note **The D bits in frames 6 and 12 are set to 1010101 when carrying internal test patterns.**

Bit control:

The following bits may be controlled on line:-
The channel bit 2s may be set to 0 (Distant/YELLOW alarm).

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive Frame Alignment (Ft) bits.

Signalling control:

A 2 bit code may be set for a selected channel.
A 2 bit code may be set for all other channels (off line).

T1 superframe format - "T1SF" (continued)

Sync pulses:

The superframe sync is coincident with frame 10.

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
EXCESS ZEROS	:	More than 31 consecutive zeros received.
YELLOW	:	Bit 2 suppressed - <3 bit 2's at 1 in a superframe.
Frame Sync Conditions	:	9 successive correct Ft bits plus 9 successive correct Fs bits.
..Loss Conditions	:	2 incorrect Ft bits in 4 Ft bits.

Data:

All D bits may be the pattern or the pattern may be in one channel only.
1 channel data may be internal patterns, external data or external voice.

Note **The data in frames 6 and 12 is not inspected for internal test patterns.**

Bit monitoring:

None.

Signalling:

A selected channels signalling is analyzed against user entered masks.

Sync pulses:

The superframe sync is coincident with frame 10.

T1 superframe format with no signalling bits - "T1SFns"

Description

As T1SF except the a b signalling bits are replaced by D bits.

TX capability

As T1SF except :	No signalling capability. Internal patterns inserted into ALL frames. Superframe sync pulse coincident with frame 12.

RX capability

As T1SF except :	No signalling capability. Internal patterns inspected in ALL frames.

T1 data mux format for DDS - "T1DM"

Description

1544kbit/s	Bits per Frame	: 193
23* 64K (56K) channels	Frames per Superframe	: 12 (1 to 12)
Normal Line Code: AMI	Bits per Superframe	: 2316

```
          bit1          bit8
F....23 * DDDDDDDD..10111..YA..0
          Chan 1-23

1  1  0  1  1  1  0  0  1  0  0  0
Ft Fv Ft Fv Ft Fv Ft Fv Ft Fv Ft Fv
```

Where Ft bits 1 0 1 0 1 0 are the terminal framing bits (FAS).
Fv bits 1 1 1 0 0 0 are the framing verify bits.
The pattern 10111...0 in 'channel 24' is fixed sync pattern.
D = Data bit (Normally bit 8 at '1' or '0' means data or control info in the other 7 bits).
Y = YELLOW/Distant/Remote Alarm bit (0 = Alarm).
A = Spare (Normally 1).

Note **For the purposes of error injection and monitoring, Ft, Fv and pattern 10111...0 are framing bits.**

TX capability

Note **The first bit of the 111000 Fv pattern will be in Frame 2.**

Data:

D bits may be a complete pattern or may be 1 channel of test/22 channels of fill/Receiver pattern. 1 channel data may be internal patterns, external data or external voice. Note that only internal PRBSs allow the eighth bit to be locked at '1', external sources must do this if required.

Bit control:

The following bits may be controlled on line:-

The Y YELLOW/Distant bit.
The A Spare bit.

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL 'channel 24' words.

Signalling control:

No signalling.

T1 data mux format for DDS - "T1DM" - (continued)

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of frame Alignment.
ERRORS	:	Error ratio greater than threshold.
EXCESS ZEROS	:	More than 31 consecutive zeros received.
YELLOW	:	Monitored Y bit.
Frame Sync Conditions	:	Align to '10111..0' and then 4 consecutive frames with correct Ft/Fv bits.
..Loss Conditions	:	4 incorrect '10111..0..F' in 12 frames.

Data:

All D bits may be the pattern or the pattern may be in one channel only 1 channel data may be internal patterns, external data or external voice. Note that only the internal PRBSs or a correctly configured 16 bit word allows the eighth bit to be assumed stuck at '1'.

Bit monitoring:

The following bit is monitored:-

The A bit.

Signalling:

No signalling.

T1 extended superframe format - "T1ESF"

Description

1544kbit/s	Bits per Frame	: 193
24* 64K (56K) channels	Frames per Superframe	: 24 (1 to 24)
Normal Line Code: B8ZS	Bits per Superframe	: 4632

```
      bit1          bit8
F....24 * DDDDDDDD    in frames 1 to 5, 7 to 11, 13 to 17 & 19 to 23
F....24 * DDDDDDDa    in frame  6
F....24 * DDDDDDDb    in frame 12
F....24 * DDDDDDDc    in frame 18
F....24 * DDDDDDDd    in frame 24
|           Chan 1-24
|
|
___M C M 0 M C M 0 M C M 1 M C M 0 M C M 1 M C M 1
```

Where 0 0 1 0 1 1 is Frame Alignment Signal (FAS).

M	=	Facility Data Link Message at 4 kbit/s.
C	=	CRC-6 bits of the preceding superframe.
D	=	Data bit.
a to d	=	A to D signalling bits for that channel (channel associated).

TX capability

Note **Frame 24 will carry the last bit of the FAS.**

Data:

D bits may be a complete pattern or may be 1 channel of test/23 channels of fill/Receiver pattern.
1 channel data may be internal patterns, external data or external voice.

Note **The D bits in frames 6, 12, 18 and 24 are set to 1010101 when carrying internal test patterns.**

Bit control:

The Facility Data Link Message may be controlled:-

The 16 bit message is set to be MMMMMMMM MMMMMMMM where M may be set to 1 or 0.

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive Frame Alignment Bits.

Signalling control:

A 4 bit code may be set for a selected channel.
A 4 bit code may be set for all other channels (off line).

Sync pulses:

The superframe sync is coincident with frame 22.

T1 extended superframe format - "T1ESF" (continued)

RX capability

Alarms:-

AIS	:	All ones
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
EXCESS ZEROS	:	More than 31 consecutive zeros received.
YELLOW	:	Alternating blocks of 11111111 and 00000000 in the Facility Data Link Message.
Frame Sync Conditions	:	9 successive correct Ft bits.
..Loss Conditions	:	2 incorrect FAS bits in 4 FAS bits.

Data:

All D bits may be the pattern or the pattern may be in one channel only.
1 channel data may be internal patterns, external data or external voice.

Note **Data in frames 6, 12, 18 and 24 is not inspected for internal test patterns.**

Bit monitoring:

None.

Signalling:

A selected channels signalling is analyzed against user entered masks.

Sync pulses:

The superframe sync is coincident with frame 22.

T1 extended superframe format with no signalling bits - "T1ESFns"

Description

As T1ESF except the a b c d signalling bits are replaced by D bits.

TX capability

As T1ESF except:	No signalling capability. Internal patterns inserted into ALL frames. Superframe sync pulse coincident with frame 24.

RX capability

As T1ESF except:	No signalling capability. Internal patterns inspected in ALL frames.

T1 SLC 96 subscriber loop carrier system - "T1slc96" - Rx only

Description

1544kbit/s	Bits per Frame	: 193
24* 64K channels	Frames per Superframe	: 72 (1 to 72)
Normal Line Code: AMI	Bits per Superframe	: 13896

F....24 * DDDDDDDD   in all frames except below
F....24 * DDDDDDDD   in frame 6, 18, 30, 42, 54 & 66
F....24 * DDDDDDDD   in frame 12, 24, 36, 48, 60 & 72
|
|
|
_ _ _   Ft Fs Ft Fs Ft Fs Ft Fs Ft Fs Ft Fs ....

With Fs = 111000111000 X X X X X X X X X X X X S S S C C C A A L L L L S

Where Ft bits 1 0 1 0 1 0 ... are the terminal framing bits.
D = Data bit.
A = A signalling bit for that channel (channel associated).
B = B signalling bit for that channel (channel associated).
X = Concentrator Field at 1.2 kbity/s arbitrarily set (fixed) to 101010.
S = Spoiler Bits 1 0 1 0
C = Channel Test Field at 0.33 kbit/s.
A = Alarm Field at 0.22 kbit/s.
L = Line switch Field at 0.44 kbit/s.

T1 Channel Assignments with Different Channel Banks - (Bell PUB 43801).
Time Slot Order:-

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
D3/D4	:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
D1D	:	1	13	2	14	3	15	4	16	5	17	6	18	7	19	8	20	9	21	10	22	11	23	12	24

RX capability

Alarms:-

AIS : All ones.
FRAME : Loss of Frame Alignment.
ERRORS : Error ratio greater than threshold.
YELLOW : Bit 2 suppressed - <3 bit 2s at 1 in a superframe (Distant).

Frame Sync Conditions : 9 successive correct Ft bits plus 9 successive correct 'framing Fs' bits.
..Loss Conditions : 2 incorrect Ft bits in 4 Ft bits.

Data:

Data may be internal patterns, external data or external voice).

Note **Data in frames 6 and 12 is not inspected for internal test patterns.**

Bit monitoring:

None.

Signalling:

A selected channels signalling is analyzed against user entered masks.

Sync pulses:

The superframe sync is coincident with frame 70.

Standard 2M format - "2M"

Description

2048kbit/s	Bits per Frame	: 256
30* 64K channels	Frames per Multiframe	: 16 (0 to 15)
Normal Line Code: HDB3	Bits per Multiframe	: 4096

	Time-slot 0	Time-slot 16
Even Frames	I 0 0 1 1 0 1 1	15 * DDDDDDDD....SSSSSSSS....15 * DDDDDDDD
Odd Frames	I 1 A U U U U U	15 * DDDDDDDD....SSSSSSSS....15 * DDDDDDDD
OR		
Even Frames	I 1 A U U U U U	15 * DDDDDDDD....SSSSSSSS....15 * DDDDDDDD
Odd Frames	I 0 0 1 1 0 1 1	15 * DDDDDDDD....SSSSSSSS....15 * DDDDDDDD
		Chan.1-15 Chan. 16-30

Signalling (Channel Associated) (S bit) Pattern:-

0 0 0 0	P L P P	in frame 0
a b c d..x	a b c d..x+15	in next 15 frames (x = 1 to 15)

Where 0 0 1 1 0 1 1 is Frame Alignment Signal (FAS).
0 0 0 0 is Multiframe Alignment Signal Word.

I	=	International Service Bits (Normally 1).
A	=	Distant (Remote) Alarm (1 = Alarm).
S	=	Signalling / Multiframe Octet.
D	=	Data bit.
U	=	Unassigned Spare Bits (Normally 1).
P	=	Spare (Normally 1).
L	=	Distant Multiframe Alarm (1 = Alarm).
abcd	=	Channel Signalling Code.

TX capability

Note **Frame 0 will contain a frame alignment signal.**

Data:

D bits may be a complete pattern or may be 1 channel of test/29 channels of fill/Receiver pattern.
1 channel data may be internal patterns, external data or external voice.

Bit control:

The following bits may be controlled on line:-

The 2 I bits.
The A (Distant) alarm bit.
The L (Distant Multiframe) alarm bit.
The U (Unassigned not frame) bits.
The P (unassigned multiframe) bits.

The not frame bit (bit 2 in not FAS).

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive FAS.
Error 1, 2, 3 or ALL Multiframe Alignment Signals.
All TS16s to all zeros.
All TS16s to all ones (64kbit/s AIS).

Standard 2M format - "2M" (continued)

Signalling control:

A 4 bit code may be set for a selected channel.
A 4 bit code may be set for all other channels.

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
MULTIFRAME	:	Loss of Multiframe Alignment.
DISTANT	:	Monitored A bit.
DISTANT MF	:	Monitored L bit.
64K AIS	:	All ones in TS16.

Frame Sync Conditions	:	Correct FAW, NFAW(bit 2), FAW sequence.
..Loss Conditions	:	3 FAWs in error.
Multiframe Sync	:	MFAW correct with a 1 in previous TS16.
..Loss Conditions	:	2 MFAWs in error, or TS16 all 0s for >= 1MF.

Data:

All D bits may be the pattern or the pattern may be in one channel only.
1 channel data may be internal patterns, external data or external voice.

Bit monitoring:

The following bits are monitored:-

The 2 I bits.
The U bits.
The P bits.

The not frame bit (bit 2 in not FAS).

Signalling:

A selected channels signalling is analyzed against user entered masks.

2M without multiframing - "2M/noMF"

Description

2048kbit/s	Bits per Frame	: 256
31* 64K channels	Frames per Multiframe	: No Multiframe
Normal Line Code : HDB3		

	Time-slot 0	Chan. 1-31
Even Frames	I 0 0 1 1 0 1 1	31 * DDDDDDDD
Odd Frames	I 1 A U U U U U	31 * DDDDDDDD
OR		
Even Frames	I 1 A U U U U U	31 * DDDDDDDD
Odd Frames	I 0 0 1 1 0 1 1	31 * DDDDDDDD

Where 0 0 1 1 0 1 1 is Frame Alignment Signal (FAS).
I = International Service Bits (Normally 1).
A = Distant (Remote) Alarm (1 = Alarm).
D = Data bit.
U = Unassigned Spare Bits (Normally 1).

TX capability

Note **'Frame 0' will contain a frame alignment signal.**

Data:

D bits may be a complete pattern or may be 1 channel of test/30 channels of fill/Receiver pattern. 1 channel data may be internal patterns, external data or external voice.

Bit control:

The following bits may be controlled on line:-

The 2 I bits.
The A (Distant) alarm bit.
The U (Unassigned not frame) bits.
The not frame bit (bit 2 in not FAS).

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive FAS.

Signalling:

None.

Sync pulses:

The transmitter (and receiver) will have a simulated 'multiframe' of 16 frames for the purposes of sync pulses.

2M without multiframing - "2M/noMF" (continued)

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
DISTANT	:	Monitored A bit.

Frame Sync Conditions	:	Correct FAW, NFAW(bit 2), FAW sequence.
..Loss Conditions	:	3 FAWs in error.

Data:

All D bits may be the pattern or the pattern may be in one channel only.
1 channel data may be internal patterns, external data or external voice.

Bit monitoring:

The following bits are monitored:-

The 2 I bits.
The U bits.
The not frame bit (bit 2 in not FAS).

Signalling:

None.

2M with CRC4 - "2M/CRC"

Description

As Standard 2M but the I bits form the CRC-4 pattern:-

C1 0 C2 0 C3 1 C4 0 C1 1 C2 1 C3 SI C4 SI

Where Cx bits are in FAW frames:-

C1/C2/C3/C4 bits are the CRC-4 bits for the preceding 'half multiframe'
0 0 1 0 1 1 is the CRC Multiframe Alignment Signal.
SI are International Service Bits (Normally 1).

TX capability

Note **Frame 0 will contain a frame alignment signal.**
Second SI bit will be in Frame 15.

Data:

D bits may be a complete pattern or may be 1 channel of test/29 channels of fill/Receiver pattern.
1 channel data may be internal patterns, external data or external voice.

Bit control:

The following bits may be controlled on line:-

The A (Distant) alarm bit.
The L (Distant Multiframe) alarm bit.
The U (Unassigned not frame) bits.
The P (unassigned multiframe) bits.
The not frame bit (bit 2 in not FAS).

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive FAS.
Error 1, 2, 3 or ALL Multiframe Alignment Signals.
All TS16s to all zeros.
All TS16s to all ones (64kbit/s AIS).

Signalling control:

A 4 bit code may be set for a selected channel.
A 4 bit code may be set for all other channels.

2M with CRC4 - "2M/CRC" (continued)

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
MULTIFRAME	:	Loss of Multiframe Alignment.
DISTANT	:	Monitored A bit.
DISTANT MF	:	Monitored L bit.
64K AIS	:	All ones in TS16.
CRC UNSYNC	:	Loss of CRC Multiframe Alignment./High CRC error ratio.

Frame Sync Conditions	:	Correct FAW, NFAW(bit 2), FAW sequence.
..Loss Conditions	:	3 FAWs in error.
Multiframe Sync	:	MFAW correct with a 1 in previous TS16.
..Loss Conditions	:	2 MFAWs in error, or TS16 all 0s for >= MF.
CRC Sync Conditions	:	2 out of 4 correct CRC MF Alignment Signal and 915 or less CRC errors per second..
..Loss Conditions	:	More than 915 CRC errors per second..

Data:

All D bits may be the pattern or the pattern may be in one channel only.
1 channel data may be internal patterns, external data or external voice.

Bit monitoring:

The following bits are monitored:-

The 2 SI bits.
The U bits.
The P bits.
The not frame bit (bit 2 in not FAS).

Signalling:

A selected channels signalling is analyzed against user entered masks.

2M with CRC, without multiframe - 2M/CnoMF

Description

As 2M with CRC4 except TS16 is replaced by D (Data) bits.

TX capability

As 2M CRC except : No signalling capability.
D bits may be in TS16.
L & P bits do not exist.
No multiframe or TS 16 Sequence Tests.

RX capability

As 2M CRC except : No signalling capability.
D bits may be in TS16.
No MULTIFRAME, DISTANT MF or 64K AIS alarms.
P bits not monitored.

2M Format with 32 frame multiframe - "2M/32Fr"

Description

2048kbit/s	Bits per Frame	: 256
30* 64K channels	Frames per Multiframe	: 32 (0 to 31)
Normal Line Code : HDB3	Bits per Multiframe	: 8192

	Time-slot 0	Time-slot 16
Even Frames	I 0 0 1 1 0 1 1	15 * DDDDDDDD....SSSSSSSS....15 * DDDDDDDD
Odd Frames	I 1 A U U U U U	15 * DDDDDDDD....SSSSSSSS....15 * DDDDDDDD
OR		
Even Frames	I 1 A U U U U U	15 * DDDDDDDD....SSSSSSSS....15 * DDDDDDDD
Odd Frames	I 0 0 1 1 0 1 1	15 * DDDDDDDD....SSSSSSSS....15 * DDDDDDDD
		Chan.1-15 Chan. 16-30

Signalling (Channel Associated) (S bit) Pattern:-

0 0 0 0	P L P P	in frame 0
a b c d..x	a b c d..x+15	in next 15 frames (x = 1 to 15)
x x x x	x x x x	in frames 16-31

Where 0 0 1 1 0 1 1 is Frame Alignment Signal (FAS).
0 0 0 0 is Multiframe Alignment Signal Word.

I	=	International Service Bits (Normally 1).
A	=	Distant (Remote) Alarm (1 = Alarm).
S	=	Signalling / Multiframe Octet.
D	=	Data bit.
U	=	Unassigned Spare Bits (Normally 1).
P	=	Spare (Normally 1).
L	=	Distant Multiframe Alarm (1 = Alarm).
abcd	=	Channel Signalling Code
X	=	Network Information (arbitrarily set / fixed to all ones).

TX capability

Note **Frame 0 will contain a frame alignment signal.**

Data:

D bits may be a complete pattern or may be 1 channel of test/29 channels of fill/Receiver pattern. 1 channel data may be internal patterns, external data orexternal voice.

Bit control:

The following bits may be controlled on line:-

The 2 I bits.
The A (Distant) alarm bit.
The L (Distant Multiframe) alarm bit.
The U (Unassigned not frame) bits.
The P (unassigned multiframe) bits.
The not frame bit (bit 2 in not FAS).

2M format with 32 frame multiframe - "2M/32Fr" (continued)

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive FAS.
Error 1, 2, 3 or ALL Multiframe Alignment Signals.
All TS16s to all zeros.
All TS16s to all ones (64kbit/s AIS).

Signalling control:

A 4 bit code may be set for a selected channel.
A 4 bit code may be set for all other channels.

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
MULTIFRAME	:	Loss of Multiframe Alignment.
DISTANT	:	Monitored A bit Multiframe Alignment.
DISTANT MF	:	Monitored L bit.
64K AIS	:	All ones in TS16.

Frame Sync Conditions	:	FAW, NFAW(bit 2), FAW sequence.
..Loss Conditions	:	3 FAWs in error.
Multiframe Sync	:	MFAW correct with a 1 in previous TS16.
..Loss Conditions	:	2 MFAWs in error, or TS16 all 0s for >= 1MF.

Data:

All D bits may be the pattern or the pattern may be in one channel only.
1 channel data may be internal patterns, external data or external voice.

Bit monitoring:

The following bits are monitored:-

The 2 I bits.
The U bits.
The P bits.
The not frame bit (bit 2 in not FAS).

Signalling:

A selected channels signalling is analyzed against user entered masks.

DS1C synchronous (mode 1) - "T1C/M1"

Note **Although muxed from two T1s the requirements that the two T1s be bit and frame synchronous, mean that this is effectively first order.**

Description

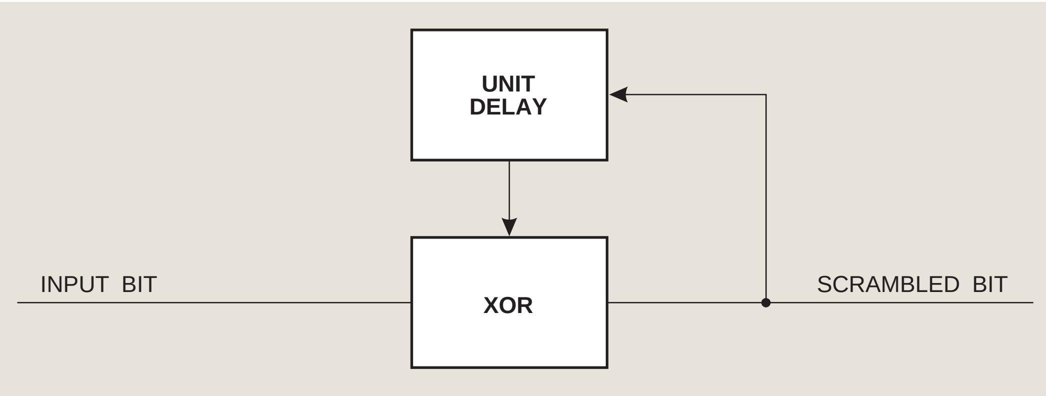
3152kbit/s	Bits per Frame	:	394
2* DSI tributaries	Frames per Superframe	:	No superframe
Normal Line Code : AMI			

The 2 tributaries A,B are bit interleaved. Together with their extra 1100 F bits they are referred to as Digroups.

SA.SB.FA1.FB1.96*D.FA2.FB2.96*D.FA3.FB3.FA4.FB4.96*D

Where SA is the F bit from the first (A) DS1 signal.
SB is the F bit from the second (B) DS1 signal.
FA1 , FA2, FA3 & FA4 are the first subframe alignment signal (1100).
FB1, FB2, FB3 & FB4 are the second subframe alignment signal (1100).
The M-Frame Alignment Signal is FA1=FB1=FA2=FB2=1 & FA3=FB3=FA4=FB4=0.
The Info (D) bits are interleaves bit-by-bit just as the SA & SB bits.

The whole stream is then scrambled by:



C1469

TX capability

Note **The transmitted sequence will have the correct SA and SB bits for each DS1 Superframe Tributary.**

Data:

Any of the internal patterns may be selected to be the complete pattern for either tributary. The other tributary is filled with the selected idle pattern.

Note **The selection of one tributary or the other is an off line change.**

Bit control:

None.

Sequence tests:

None.

DS1C synchronous (mode 1) - "T1C/M1" (continued)

Signalling control:

None.

Sync pulses:

The transmitter (and receiver) will have a simulated 'superframe' of 2 frames for the purposes of sync pulses.

RX capability

Note **The Receiver completely ignores the SA and SB bits.**

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
EXCESS ZEROS	:	More than 31 consecutive zeros received.
Frame Sync Conditions	:	10 successive correct Frame Alignment bits (FA/FB).
..Loss Conditions	:	2 in 4 bits in error.

Data:

All of the D bits for one selected tributary are used for investigating pattern errors.

Bit monitoring:

None.

Signalling:

None.

DS1C asynchronous (mode 2) - "T1C/M2"

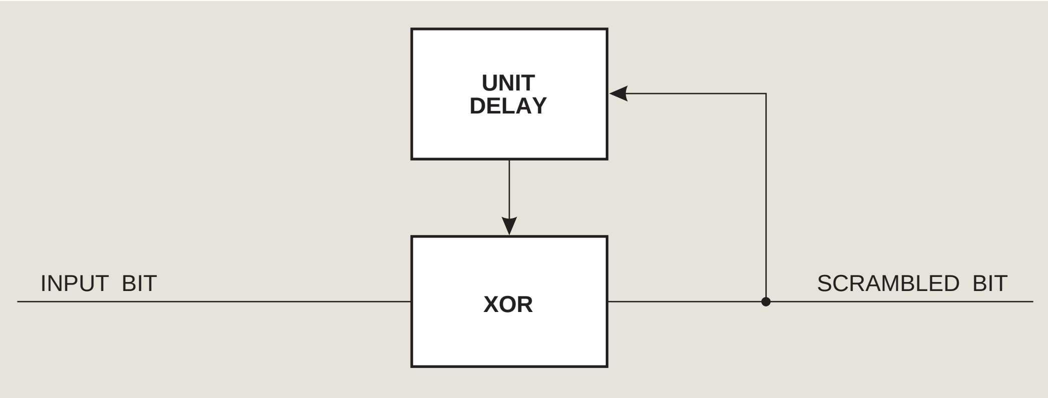
Description

3152kbit/s	Bits per Frame	: 318
2* DSI tributaries	Frames per Superframe	: 4 (1 to 4)
Normal Line Code : AMI	Bits per Superframe	: 1272

M.. 52*D. .C1. .52*D. .F1. .52*D. .C2. .52*D. .C3. .DDDD.(DA).47*D. .F2. .52*D frame 1
M.. 52*D. .C1. .52*D. .F1. .52*D. .C2. .52*D. .C3. .DDDDD.(DB).46*D. .F2. .52*D frame 2
M.. 52*D. .C1. .52*D. .F1. .52*D. .C2. .52*D. .C3. .DDDD.(DA).47*D. .F2. .52*D frame 3
X.. 52*D. .C1. .52*D. .F1. .52*D. .C2. .52*D. .C3. .DDDDD.(DB).46*D. .F2. .52*D frame 4

Where M bits 0 1 1 is the Frame Alignment Signal.
X = YELLOW/Distant Alarm bit (0 = Alarm).
F1 = 0, F2 = 1 is the Subframe Alignment Signal.
C bits are stuffing indicatorsC1 = C2 = C3 = 1 indicates stuff.
C1 = C2 = C3 = 0 indicates no stuff.
DA is the stuff bit for tributary A.
DB is the stuff bit for tributary B
The Info (D) bits are interleaved bit-by-bit in the order A-B-A etc., the source being the full '193 data bits' from the two DS1 tributaries.

The whole stream is then scrambled by:



C1469

Note

Tributary 2 is normally inverted after justification but before combining but the 2851 &2851S does not do this. For the purposes of error injection and monitoring, F1, F2 & Mbits are framing bits.

DS1C asynchronous (mode 2) - "T1C/M2" (continued)

TX capability

Note **Nominal justification rate - 0.457. The other tributaries justification rate will be identical by using same C1, C2 and C3 bits but by inverting them.**

Justified bits are set to '1', not the value of the previous bit. The tributaries do not carry a proper DS1 framing pattern.

The data bit after the Cx bits is not a pattern bit (it is unspecified).

Data:

Any of the internal patterns may be selected to be the complete pattern for either tributary. The other tributary is filled with the selected idle pattern.

Note **The selection of one tributary or the other is an off line change.**

Bit control:

The following bit may be controlled

The X/YELLOW/Distant bit.

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive F1bits.

Signalling control:

None.

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
EXCESS ZEROS	:	More than 31 consecutive zeros received.
YELLOW	:	Monitored X bit.
Frame Sync Conditions	:	9 successive correct Frame Alignment bits (F1/F2) and then 5 successive correct M bits.
..Loss Conditions	:	2 in 4 bits in error (F1/F2).

Data:

All of the D bits for one selected tributary are used for investigating pattern errors except the D bit after the Cx bit which is ignored.

Bit monitoring:

None.

Signalling:

None.

DS2 asynchronous - M12 multiplex format - "T2async"

Description

6312kbit/s	Bits per Frame	: 294
4* DSI tributaries	Frames per Superframe	: 4 (1 to 4)
Normal Line Code : B6ZS	Bits per Superframe	: 1176

M. . 48*D. .C1. .48*D. .F1. .48*D. .C2. .48*D. .C3. .48*D. .F2. .(JA)DDD...44*D frame 1
M. . 48*D. .C1. .48*D. .F1. .48*D. .C2. .48*D. .C3. .48*D. .F2. .D(JB)DD...44*D frame 2
M. . 48*D. .C1. .48*D. .F1. .48*D. .C2. .48*D. .C3. .48*D. .F2. .DD(JC)D...44*D frame 3
X. . 48*D. .C1. .48*D. .F1. .48*D. .C2. .48*D. .C3. .48*D. .F2. .DDD(JD)...44*D frame 4

Where M bits 0 1 1 is the Frame Alignment Signal.
X = YELLOW/Distant Alarm bit (0 = Alarm).
F1 = 0, F2 = 1 is the subframe Alignment Signal.
C bits are stuffing indicators
C1 = C2 = C3 = 1 indicates stuff,
C1 = C2 = C3 = 0 indicates no stuff.
JA is the stuff bit for tributary A.
JB, JC and JD are similar.

The Info (D) bits are interleaved bit-by-bit in the order A-B-C-D-A etc., the sources being the full '193 data bits' from the four DS1 tributaries.

Note **Tributaries 2 & 4 are normally inverted after justification but before combining but the 2851 &2851S does not do this on the transmitter or the receiver. For the purposes of error injection and monitoring, F1, F2 and Mbits are framing bits.**

TX capability

Note **Nominal Justification Ratio = 0.334. The other tributaries justification rate will be identical by using the same C1, C2 and C3 bits, inverted as necessary.**

Justified bits are set to '1', not the value of the previous bit.

The tributaries do not carry a proper DS1 framing pattern.

The data bit after the Cx bits is not a pattern bit (it is unspecified).

Data:

Any of the internal patterns may be selected to be the complete pattern for any tributary. The other tributaries are filled with the selected idle pattern.

Note **The selection of one tributary or another is an off line change.**

Bit control:

The following bits may be controlled:-

The X/YELLOW/Distant bit.

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive F1 bits.

Signalling control:

None.

DS2 asynchronous - M12 multiplex format - "T2async" (continued)

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
EXCESS ZEROS	:	More than 31 consecutive zeros received.
YELLOW	:	Monitored X bit.

Frame Sync Conditions	:	10 successive correct Frame Alignment bits (F1/F2) plus 5 successive correct Mbits.
..Loss Conditions	:	2 in 4 bits in error (F1/F2).

Data:

All of the D bits for one selected tributary are used for investigating pattern errors except the D bit after the Cx bit which is ignored.

Bit monitoring:

None.

Signalling:

None.

DS2 synchronous format - "T2sync"

Description

6312kbit/s	Bits per Frame	:	789
96 * 64K channels	Frames per Superframe	:	4 (1 to 4)
Normal Line Code : B6ZS	Bits per Superframe	:	3156

```
Time-slot 1-96 TS97 & 98
96*DDDDDDDD....16*S.........1   1   0   0   M      frame 1
96*DDDDDDDD....16*S.........1   0   1   0   0      frame 2
96*DDDDDDDD....16*S.........X   X   X   A   M      frame 3
96*DDDDDDDD....16*S.........C   C   C   C   C      frame 4
           Chan 1-96
```

Where 1 1 0 0 1 0 1 0 0 is the Frame Alignment Signal.

- M = Data Link Bits at 4kbit/s.
- X = Spare bits (Normally 1).
- A = YELLOW/Distant/Remote Alarm bit (1 = Alarm).
- C = CRC5 bits for this multiframe.
- S = Signalling Bits ST1 to ST16 where each carries the signalling for 6 channels in the sequence FS.S1.S2.S3.S4.S5.S6.Fx where the Fs bits are a 0 1 0 1 0 sequence and Fx is optional/spare bit.
- D = Data bits.

TX capability

Note **The Mbits will all be set to '1'.**

Data:

D bits may be a complete pattern or may be 1 channel of test/95 channels of fill/Receiver pattern.1 channel data may be internal patterns or external data.

Bit control:

The following bits may be controlled on line:-

The A/YELLOW bit.

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive Frame Alignment Words.

Signalling control:

None. The correct Fs sequence will be present in all STx bits but signalling bits and the Fx bit will be set to all ones.

Sync pulses:

The transmitter (and receiver) will have a 'simulated superframe' of 16 frames for the purposes of sync pulses.

DS2 synchronous format - "T2sync" (continued)

RX capability

Alarms:-

AIS	: All ones.
FRAME	: Loss of Frame Alignment.
ERRORS	: Error ratio greater than threshold.
EXCESS ZEROS	: More than 31 consecutive zeros received.
YELLOW	: Monitored A bit.

Frame Sync Conditions	: 1 correct frameword.
..Loss Conditions	: 4 consecutive incorrect framewords.

Data:

All D bits may be the pattern or the pattern may be in one channel only.
1 channel data may be internal patterns or external data.

Bit monitoring:

The following bits are monitored:-

The three X bits.

Signalling:

None.

6M interworking G74x - "6M/IW"

Description

6312kbit/s	Bits per Frame	: 840
3 * 2M tributaries	Frames per Superframe	: No Superframe
Normal Line Code: B6ZS		

```
11010000. .159*D. .A. .P. .Y. .165*D. .  C C C. .165*D. .  C C C. .165*D. .  C C C. .JJJ. .162*D
                                         C  j  1            C  j  2            C  j  3
```

Where 111010000 is the Frame Alignment Word.

A = Alarm/YELLOW bit (1 = Alarm).
P = Parity bit - 1 if the number of marks in all tributary bits including the bits in the justifiable time slots in the preceding frame is even, 0 if odd.
Y = Spare (Normally 1).
N = National Bit (Normally 1).
C bits are stuffing (justification) indicators.
CCC = CA.CB.CC where CA is C bit for tributary A.
Cj1 = Cj2 = Cj3 = 1 indicates justification.
Cj1 = Cj2 = Cj3 = 0 indicates no justification.
J is the justifiable bit.
JJJ = JA.JB.JC where JA is the justifiable bit for tributary A.

The Info (D) bits are interleaved bit-by-bit in the order A-B-C-A etc., the sources being the full 2M bit streams.

TX capability

Note **Nominal Justification Ratio = 0.453. The other tributaries justification rate will be identical by using the same Cji (i=1-3) bits.**

Justified bits are set to '1', not the value of the previous bit.

The tributaries do not carry a proper 2M framed pattern.

Data:

Any of the internal patterns may be selected to be the complete pattern for any tributary. The other tributaries are filled with the selected idle pattern.

Note **The selection of one tributary or another is an off line change.**

Bit control:

The following bits may be controlled:-

The A/YELLOW bit.
The Y/Spare bit.

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive Frame Alignment Words.

Signalling control:

None.

Sync pulses:

The transmitter (and receiver) will have a 'simulated superframe' of 2 frames for the purposes of sync pulses.

6M interworking G74x - "6M/IW" (continued)

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
EXCESS ZEROS	:	More than 31 consecutive zeros received.
YELLOW	:	Monitored A bit.

Frame Sync Conditions	:	3 consecutive correct Frame Alignment Words.
..Loss Conditions	:	4 consecutive incorrect FAW.

Data:

All of the D bits for one selected tributary are used for investigating pattern errors.

Bit monitoring:

The following bits are monitored:-

The Y/Spare bit.

Note **The P bit will be treated as a 'CRC bit' and will generate CRC measurements.**

Signalling:

None.

8M asynchronous G.742 - "8M/742"

Description

8448kbit/s — Bits per Frame : 848
4 * 2M tributaries — Frames per Multiframe : No Multiframe
Normal Line Code: HDB3

```
                                                                      Pos
                          1 2 3 4             1 2 3 4             1 2 3 4   1234
1111010000. .A. .N. .200*D. . C C C C. .208*D. . C C C C. .208*D. . C C C C. .  JJJJ. .204*D
                          C j 1               C j 2               C j 3
```

Where 1111010000 is the Frame Alignment Signal/Word.
A = Distant Alarm bit (Alarm = 1).
N = National Bit (Normally 1).
C bits are stuffing (justification) indicators. CCCC = C1.C2.C3.C4.
Where C1 is C bit for tributary 1, C2 for trib. 2, etc.
Cj1 = Cj2 = Cj3 = 1 indicates justification.
Cj1 = Cj2 = Cj3 = 0 indicates no justification.
J is the justifiable bit.
JJJJ = J1.J2.J3.J4 where J1 is the justifiable bit for tributary 1 etc.

The Info (D) bits are interleaved bit-by-bit in the order 1-2-3-4-1 etc., the sources being the full 2M tributaries.

TX capability

Note **Nominal Justification Ratio = 0.424. The other tributaries justification rate will be identical by using the same Cji (i=1-4) bits.**

Justified bits are set to '1', not the value of the previous bit.

The tributaries do not carry a proper 2M framed pattern.

Data:

Any of the internal patterns may be selected to be the complete pattern for any tributary. The other tributaries are filled with the selected idle pattern.

Note **The selection of one tributary or another is an off line change.**

Bit control:

The following bits may be controlled:-

The A/DISTANT bit.
The N/National bit.

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive Frame Alignment Words.

Signalling control:

None.

Sync pulses:

The transmitter (and receiver) will have a 'simulated multiframe' of 2 frames for the purposes of sync pulses.

8M asynchronous G.742 - "8M/742" (continued)

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
DISTANT	:	Monitored A bit.

Frame Sync Conditions	:	3 consecutive correct Frame Alignment Words.
..Loss Conditions	:	4 consecutive incorrect FAW.

Data:

All of the D bits for one selected tributary are used for investigating pattern errors.

Bit monitoring:

The following bit is monitored:-

The N bit.

Signalling:

None.

8M asynchronous G.745 - "8M/745"

Description

8448kbit/s	Bits per Frame	:	1056
4 * 2M tributaries	Frames per Multiframe	:	No Multiframe
Normal Line Code: HDB3			

```
                                                                                  Neg    Pos
                         1 2 3 4                        1 2 3 4                        1 2 3 4   ----   ----
11100110. .256*D. .  C C C C. .SSSS. .256*D. .  C C C C. .UUAU. .256*D. . C C C C. .JJJJ. .  JJJJ. .252*D
 TS 0                     Time-slot33                   Time-slot66
```

Where 11100110 is the Frame Alignment Word.

U = Unassigned bits (normally 1).
A = Distant Alarm bit (1 = Alarm).
S = Digital Service Channel Bits.
C bits are Justification Control bits for each tributary as follows:-
Cj bits 111 in two successive frames = positive justification.
JNeg=packing JPos=packing.
Cj bits 000 in two successive frames = negative justification.
JNeg=data JPos=data.
Cj bits 111 followed by 000 in next frame = zero justification.
JNeg=packing Jpos=data.
Cj bits 000 followed by 111 in next frame = zero justification.
JNeg bits are the justifiable bits for negative justification.
JPos bits are the justifiable bits for positive justification.
D = Data bit.

TX capability

Note **Nominal Justification Ratio = 0 for all tributaries. JNeg bits will be fixed at 1, JPos bits will be data (D) bits.**

Data:

Any of the internal patterns may be selected to be the complete pattern for any tributary. The other tributaries are filled with the selected idle pattern.

Note **The selection of one tributary or another is an off line change.**
The tributaries do not carry a proper 2M framed pattern.

Bit control:

The following bits may be controlled:-

The A/DISTANT bit.
The U bits.
The S bits.

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive Frame Alignment Words.

Signalling control:

None.

8M asynchronous G.745 - "8M/745" (continued)

Sync pulses:

The transmitter (and receiver) will have a 'simulated multiframe' of 2 frames for the purposes of sync pulses.

RX capability

Alarms:

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
DISTANT	:	Monitored A bit.

Frame Sync Conditions	:	2 consecutive correct Frame Alignment Words.
..Loss Conditions	:	5 consecutive incorrect FAW.

Data:

All of the D bits for one selected tributary are used for investigating pattern errors.

Bit monitoring:

The following bits are monitored:-

The U bits.
The S bits.

Signalling:

None.

8M synchronous G.744 (G.704 sec 6) - "8M/744"

Description

8448kbit/s	Bits per Frame	:	1056
120 * 64K channels	Frames per Multiframe	:	16 (0 to 15)
Normal Line Code: HDB3	Bits per Multiframe	:	16896
	Time Slots per Frame	:	132 (0 to 131)

TS0	1-4	5-32	33	34-65	66	67-70	71-98	99	100-131
11100110.	.32*N. .	224*D. .	8*K. .	256*D. .	100000. .AS^1. .	32*B. .	224*D. .	CCCCCCES^2. .	256*D
Channel		1-28		29-60			61-88		89-120

Channel Associated Signalling (B bit) Pattern :-

	TS 67		TS 68		TS 69		TS 70	
Frame 0:	0 0 0 0	P L P P	0 0 0 0	P L P P	0 0 0 0	P L P P	0 0 0 0	P L P P
Frame 1:	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
for TS	5	2 0	3 6	5 1	7 1	8 6	1 0 2	1 1 7
for chan	1	1 6	3 1	4 6	6 1	7 6	9 1	1 0 6
.								
.								
Frame 15	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
for TS	1 9	3 5	5 0	6 5	8 5	1 0 1	1 1 6	1 3 1
for chan	1 5	3 0	4 5	6 0	7 5	9 0	1 0 5	1 2 0

Where 11100110 .. 100000 is the Frame Alignment Word.

N = National bits (Normally 1).
K = National bits (Normally 1).
A = DISTANT Alarm bit (1 = Alarm).
S^1 = Spare bit (Normally 1).
S^2 = Spare bit (Normally 0).
0000 0000 0000 0000 are the Multiframe Alignment Words
(These 16 bits are a 'Super MFAW' - SMFAW).
L = DISTANT MF bits (1 = Alarm).
P = Spare bits (Normally 1).
ABCD = Signalling Code bits for each channel.
D = Data bit.
C = CRC6 bit for previous frame.
E = Indication of CRC block error (Normally 0).

TX capability

Data:

D bits may be a complete pattern or may be 1 channel of test/120(125) channels of fill/Receiver pattern. 1 channel data may be internal patterns or external data.

Note **Time slots 1 - 4, 33 are treated as channels and may be filled with test patterns, idle patterns or external data. They are selected as TS1 - 4 = Chan. 121 - 124, TS33 = Chan. 125.**

Bit control:

The following bit may be controlled on line:-

The A/DISTANT bit.
The S/Spare bit.

8M synchronous G.744 (G.704 sec 6) - "8M/744" (continued)

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive Frame Alignment Words.
Error 1, 2, 3 or ALL successive 'Super Multi-Frame Alignment Words'.

Signalling control:

None. The transmitted stream will contain the correct Frame 0 sequence of 0000 1011 in TS67 - 70. All signalling codes ABCD will be set to 0101.

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
MULTIFRAME	:	Loss of Multiframe Alignment in any of the 4 Time Slots.
DISTANT	:	Monitored A bit.

Frame Sync Conditions	:	3 successive correct FAWs.
..Loss Conditions	:	4 incorrect FAWs.
Multiframe Sync	:	1 correct SMFAW.
..Loss Conditions	:	2 successive incorrect SMFAW.

Data:

All D bits may be the pattern or the pattern may be in one channel only.
1 channel data may be internal patterns or external data.

Note **Time-slots 1 - 4, 33 & 66 are also available.**

Bit monitoring:

The following bit is monitored:-

The S (Spare) bit.

Signalling:

None.

8M synchronous G.741 (G.741 Annex A) - "8M/741"

Description

8448kbit/s	Bits per Frame	:	1056
4* 2M tributaries	Frames per Multiframe	:	16 (0 to 15)
Normal Line Code: HDB3	Bits per Multiframe	:	16896
	Time Slots per Frame	:	132 (0 to 131)

TS0	1-4	5-32	33	34-65	66	67-70	71-98	99	100-131
11100110. .	32*N. .	224*D. .	8*K. .	256*D. .	100000. .AS. .	32*B. .	224*D. .	8*K. .	256*D
Channel:		1-28		29-60			61-88		89-120

Where 11100110 .. 100000 is the Frame Alignment Word.
F bits are the TS0s of the 4 2M tributaries.
B bits are the TS16s of the 4 2M tributaries.
K = National bits (Normally 1).
A = DISTANT Alarm bit (1 = Alarm).
S = Spare bit (Normally 1).

The info (D) bits are cyclic time-slot interleaved from the four tributaries.

Note **The 4 2M tributaries are not neccessarily 'Frame 0 aligned'.**

TX capability

Note **TS1-4 in Frame 0 (and all odd frames) will contain four 2M frame alignment words (10011011).**
TS1-4 in Frame 1 (and all even frames) will contain four 2M not frame alignment words (11011111).
TS67-70 in Frame 0 will contain four 2M multiframe alignment words (0000 1011).
TS67-70 in all other frames will contain idle signalling codes (0101 0101).

Data:

Any of the internal patterns may be selected to be the complete pattern for any tributary. The other tributaries are filled with the selected idle pattern.

Note **The selection of one tributary or another is an off line change.**

Bit control:

The following bit may be controlled on line:-

The A/DISTANT bit.
The S/Spare bit.
The K bits in TS33 & TS99.

Sequence tests:

Error 1, 2, 3, 4, 5 or ALL successive Frame Alignment Words.

Signalling control:

None. The transmitted stream will contain the correct Frame 0 sequence of 0000 1011 in TS67-70. All signalling codes ABCD will be set to 0101.

8M synchronous G.741 (G.741 Annex A) - "8M/741" (continued)

RX capability

Alarms:-

AIS	:	All ones.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
DISTANT	:	Monitored A bit.

Frame Sync Conditions	:	3 successive correct FAWs.
..Loss Conditions	:	4 incorrect FAWs.

Data:

All of the D bits for one selected tributary are used for investigating pattern errors.

Bit monitoring:

The following bits are monitored:-

The S (Spare) bit.

Signalling:

None.

34M asynchronous G.751 - "34M"

2852(S), 2853(S), 2854S & 2855S only

Description

34368 kbit/s	Bits per Frame	:	1536
4 * 8 Mbit tributaries	Frames per Multiframe	:	No multiframe
Normal Line Code: HDB3	Nominal Justification Ratio	:	0.436

```
                                                         Pos
                    1 2 3 4          1 2 3 4          1 2 3 4   1234
1111010000..A..N..372*D.. C C C C..380*D.. C C C C..380*D.. C C C C.. JJJJ..  376*D
                    C  j  1          C  j  2          C  j  3
```

Where 1111010000 is the Frame Alignment Signal/Word.
A = DISTANT Alarm bit (Alarm = 1).
N = National bit (Normally 1).
C bits are stuffing (justification) indicators.
CCCC = C1.C2.C3.C4 where C1 is control bit for tributary 1, C2 for tributary 2, etc
Cj1 = Cj2 = Cj3 = 1 indicates justification
Cj1 = Cj2 = Cj3 = 0 indicates no justification
J is the justifiable bit.
JJJJ = J1.J2.J3.J4 where J1 is the justifiable bit for tributary 1 etc.

The info (D) bits are interleaved bit-by-bit in the order 1-2-3-4-1 etc, the sources being the full 8M tributaries.

TX capability

Data:

A selected 8 Mbit tributary may contain either a selected 8 Mbit system or may be a 8M/742 system and contain in a tributary a selected 2 Mbit system or may be an unframed 8 Mbit signal. All other tributaries contain a repetitive pattern, a PRBS or a copy of the selected tributary.

Sequence tests:

None

Signalling capability:

None

Sync pulses:

None

34M asynchronous G.751 - "34M" (continued)

RX capability

Alarms:-

LINE	:	Signal Loss.
AIS	:	All ones, recognised in presence of 1 in 10^3 errors.
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
DISTANT	:	Monitored A bit.

Frame Sync Conditions	:	3 consecutive correct Frame Alignment Words.
..Loss Condition	:	4 consecutive incorrect Frame Alignment Words.

Data:

A selected 8 Mbit tributary may contain an 8 Mbit system or an 8M/742 system for further demuxing or may contain an unframed 8 Mbit signal.

140M asynchronous G.751 - "140M"

2854S & 2855S only

Description

139264 kbit/s	Bits per Frame	: 2928
Bits per tributary: 723	Max justification rate per tributary	: 47,563 bit/s
4 * 34 Mbit tributaries	Frames per Multiframe	: No multiframe
Normal Line Code: CMI	Nominal Justification Ratio	: 0.419

```
                          1 2 3 4          1 2 3 4
111110100000..A..NNN..472*D.. C C C C..484*D.. C C C C..484*D
                          C  j  1          C  j  2

                          1 2 3 4          1 2 3 4          1 2 3 4   1234
                       .. C C C C..484*D.. C C C C..484*D.. C C C C.. JJJJ..480*D
                          C  j  3          C  j  4          C  j  5
```

Where 111110100000 is the Frame Alignment Signal/Word.
A = Distant Alarm bit (13) (Alarm = 1)
N = National bit (14) (Normally 1)
N = National bit (15) (Normally 1)
N = National bit (16) (Normally 1)
C bits are stuffing (justification) indicators.
CCCC = C1.C2.C3.C4 where C1 is Control bit for tributary 1,
C2 for tributary 2, etc and
Cj1 = Cj2 = Cj3 = Cj4 = Cj5 = 1 indicates pos. justification
Cj1 = Cj2 = Cj3 = Cj4 = Cj5 = 0 indicates no justification
J is the justifiable bit.
JJJJ = J1.J2.J3.J4 where J1 is the justifiable bit for tributary 1 etc.

The info (D) bits are interleaved bit-by-bit in the order 1-2-3-4-1 etc, the sources being the full 34M tributaries.

TX capability

Data:

A selected 140 Mbit tributary may either contain a selected 34 Mbit system or an unframed 34 Mbit signal. All other tributaries contain a repetitive pattern, a PRBS or a copy of the selected tributary.

Sequence tests:

None

Signalling capability:

None

Sync pulses:

None

140M asynchronous G.751 - "140M" (continued)

RX capability

Alarms:-

LINE	:	Signal Loss.
AIS	:	All ones, recognised in presence of 1 in 10^3 errors except when frame word present (4 or less zeros in 2928 bits)
FRAME	:	Loss of Frame Alignment.
ERRORS	:	Error ratio greater than threshold.
DISTANT	:	Monitored A bit.

Frame Sync Conditions	:	3 consecutive correct Frame Alignment Words.
..Loss Condition	:	4 consecutive incorrect FAW.

Data:

A selected 140 Mbit tributary may contain an 34 Mbit tributary with further tributary assignments also at 8 Mbit and 2 Mbit or may contain an unframed 34 Mbit signal.

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