



INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**G.774.3**

(02/2001)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA,  
DIGITAL SYSTEMS AND NETWORKS

Digital terminal equipments – Operations, administration  
and maintenance features of transmission equipment

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**Synchronous digital hierarchy (SDH) –  
Management of multiplex-section protection for  
the network element view**

ITU-T Recommendation G.774.3

(Formerly CCITT Recommendation)

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## ITU-T Recommendation G.774.3

### Synchronous digital hierarchy (SDH) – Management of multiplex-section protection for the network element view

#### Summary

This Recommendation provides an information model for the Synchronous Digital Hierarchy (SDH). This model describes the managed object classes and their properties for the protection switching function, as defined in ITU-T G.803 and as related to SDH transmission resources. These objects are useful to describe information exchanged across interfaces defined in ITU-T M.3010 Telecommunications Management Network (TMN) architecture for the management of the protection function.

Document History	
Issue	Notes
2001	First revision incorporated the changes documented in the G.774.3 Corrigendum 1.
11/1994	Initial version of the Recommendation.

#### Source

ITU-T Recommendation G.774.3 was revised by ITU-T Study Group 15 (2001-2004) and approved under the WTSA Resolution 1 procedure on 9 February 2001.

## FOREWORD

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In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

## NOTE

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## ITU-T Recommendation G.774.3

### Synchronous digital hierarchy (SDH) – Management of multiplex-section protection for the network element view

#### 1 Scope

This Recommendation provides an information model, as related to the protection function for the Synchronous Digital Hierarchy (SDH). It identifies the Telecommunications Management Network (TMN) object classes required for the management of the protection function for SDH network elements. These objects are relevant to information exchanged across standardized interfaces defined in the Recommendation ITU-T M.3010 TMN architecture.

This Recommendation applies to SDH network elements which perform the Multiplex Section protection function and those systems in the TMN that manage SDH network elements. Functional capabilities of SDH multiplex equipment, particularly the Multiplex Section protection switching function, are given in ITU-T G.783. Performance monitoring requirements for Multiplex Section protection (for the management of SDH equipment with this capability) are provided in ITU-T G.784, however, the information model which supports these can be found in ITU-T G.774.1.

The new objects defined in this Recommendation supersede those defined in ITU-T G.774.3 (1994). For each object class, attribute, action, notification, parameter defined in this Recommendation it shall be indicated what the impacts upon the existing ITU-T G.774.3 (1994) are.

#### Structure of this Recommendation

Clause 5.1 provides an overview of the SDH protection information model in this Recommendation. Clauses 3 to 15 describe the information model using the notation mechanisms defined in ITU-T X.722 Guidelines for the Definition of Managed Objects. Clause 15 contains the syntax definitions of the information carried in the protocol using Abstract Syntax Notation One (ASN.1) defined in ITU-T X.680-X.683. Naming and Inheritance are diagrammatically shown in informative Appendix I. Diagrams illustrating the application of the SDH protection model are provided in informative Appendix II.

#### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision: users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- ITU-T G.707/Y.1322 (2000), *Network node interface for the synchronous digital hierarchy (SDH)*.
- ITU-T G.773 (1993), *Protocol suites for Q-interfaces for management of transmission systems*.
- ITU-T G.774 (2001), *Synchronous digital hierarchy (SDH) – Management information model for the network element view*.
- ITU-T G.783 (2000), *Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks*.

- ITU-T G.784 (1999), *Synchronous digital hierarchy (SDH) management*.
- ITU-T G.803 (2000), *Architecture of transport networks based on the synchronous digital hierarchy (SDH)*.
- ITU-T G.831 (2000), *Management capabilities of transport networks based on the synchronous digital hierarchy (SDH)*.
- ITU-T G.958 (1994), *Digital line systems based on the synchronous digital hierarchy for use on optical fibre cables*.
- ITU-T M.60 (1993), *Maintenance terminology and definitions*.
- ITU-T M.2120 (2000), *PDH path, section and transmission system and SDH path and multiplex section fault detection and localization procedures*.
- ITU-T M.3010 (2000), *Principles for a telecommunications management network*.
- ITU-T M.3013 (2000), *Considerations for a telecommunications management network*.
- ITU-T M.3100 (1995), *Generic network information model*.
- ITU-T Q.811 (1997), *Lower layer protocol profiles for the Q3 and X interfaces*.
- ITU-T Q.812 (1997), *Upper layer protocol profiles for the Q3 and X interfaces*.
- ITU-T Q.822 (1994), *Stage 1, Stage 2 and Stage 3 description for the Q3-interface – Performance management*.
- ITU-T X.680 to X.683 (1997), *Information technology – Abstract Syntax Notation One (ASN.1)*.
- ITU-T X.701 (1997), *Information technology – Open Systems Interconnection – Systems management overview*.
- ITU-T X.710 (1997), *Information technology – Open Systems Interconnection – Common management information service*.
- ITU-T X.711 (1997), *Information technology – Open Systems Interconnection – Common management information protocol: Specification*.
- ITU-T X.720 (1992), *Information technology – Open Systems Interconnection – Structure of Management Information: Management information model, plus Amd.1 (1995) and Cor.1 (1994)*.
- ITU-T X.721 (1992), *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information, plus Cor.1 (1994), Cor.2 (1996), Cor.3 (1998) and Cor.4 (2000)*.
- ITU-T X.722 (1992), *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects, plus Amd.1 (1995), Amd.2 (1997) and Cor.1 (1996)*.
- ITU-T X.730 (1992), *Information technology – Open Systems Interconnection – Systems management: Object management function, plus Amd.1 (1995) and Amd.1/Cor.1 (1996)*.
- ITU-T X.731 (1992), *Information technology – Open Systems Interconnection – Systems management: State management function, plus Amd.1 (1995), Cor.1 (1995) and Amd.1/Cor.1 (1996)*.
- ITU-T X.733 (1992), *Information technology – Open Systems Interconnection – Systems management: Alarm reporting function, plus Cor.1 (1994), Amd.1 (1995), Amd.1/Cor.1 (1996) and Cor.2 (1999)*.

- ITU-T X.734 (1992), *Information technology – Open Systems Interconnection – Systems management: Event report management function, plus Cor.1 (1994), Amd.1 (1995), Amd.1/Cor.1 (1996) and Cor.2 (1999).*
- ITU-T X.735 (1992), *Information technology – Open Systems Interconnection – Systems management: Log control function, plus Amd.1 (1995) and Amd.1/Cor.1 (1996).*

### **3 Terms and Definitions**

This Recommendation uses the terms and definitions defined in ITU-T G.774, ITU-T G.784 and ITU-T M.3100.

### **4 Abbreviations**

This Recommendation uses the following abbreviations:

APDU	Application Protocol Data Unit
APS	Automatic Protection Switching
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CTP	Connection Termination Point
ISO	International Organization for Standardization
ITU	International Telecommunication Union
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
LOS	Loss of Signal
MS	Multiplex Section
MSP	Multiplex Section Protection
NE	Network Element
OS	Operations System
OSI	Open Systems Interconnection
Pkg	Package
RDN	Relative Distinguished Name
SD	Signal Degrade
SDH	Synchronous Digital Hierarchy
SF	Signal Fail
STM-N	Synchronous Transport Module N
TMN	Telecommunications Management Network
TP	Termination Point
TTP	Trail Termination Point
WTR	Wait-to-Restore

## 5 Multiplex-section protection management model

### 5.1 Overview

The SDH information model for the multiplex-section protection switching function is based on the requirements to provide the protection function for transmission in SDH networks. Resources which must be protected have been modelled and are described in ITU-T G.774. They are based on the Generic Network Information Model of ITU-T M.3100. The Generic Network Information Model includes a Termination Point fragment which serves as a structure for specialization for specific technologies such as the SDH.

The information exchanged at a management interface is modelled using design principles outlined in ITU-T X.720 Management Information Model. Resources are modelled as objects, and the management view of a resource is a managed object. Objects with similar attributes may be grouped into object classes. An object is characterized by its object class and object instance, and may possess multiple attribute types and associated values. The terms managed object class and managed object instance apply specifically to objects that are being managed. This Recommendation specifies the properties of the resource visible for management.

An object class may be a subclass of another class. A subclass inherits attribute types, packages and behaviours of its super class, in addition to possessing its own specific attributes and properties. The SDH specific object classes are all derived from super classes in the Generic Network Information Model ITU-T M.3100.

Object classes and attribute types are defined only for the purpose of communicating network management messages between systems, and need not be related to the structure of data within those systems. The object classes defined in this issue of the SDH information model can apply to multiple management functional areas (e.g. fault management and configuration management).

There are several different viewpoints of management information that may be defined for management purposes. The network element viewpoint is concerned with the information that is required to manage a network element. This refers to information required to manage the protection function and the physical aspects of the network element. This Recommendation addresses only the network element viewpoint.

#### Revisions that require re-registration

This clause provides replacement managed object class definitions for the existing ITU-T G.774.3 (1994). Any managed object class replaced by one in this clause is considered to be deprecated. The reasons for the replacement of a managed object class are as follows:

- 1) The replaced managed object class is faulty and must be fixed.
- 2) The replaced managed object class includes an attribute, package, notification or action which has been re-registered in this or another Recommendation.
- 3) The replaced managed object class inherits from a managed object class which has been re-registered in this or another Recommendation.

In each case where a class is replaced, the new class will be registered within this Recommendation. The textual label for the class will be revised to include the text "R1". For example, in the managed object class "protectionGroup", the revised label will become "protectionGroupR1".

Below is a table of classes deprecated from ITU-T G.774.3 (1994) and the G.774.3 classes which replace them:

<i>Deprecated G.774.3 (1994) Classes</i>	<i>Replacement G.774.3 Classes</i>
protectionGroup	protectionGroupR1
sdhMSProtectionGroup	sdhMSProtectionGroupR1

## 5.2 SDH multiplex-section protection requirements

The SDH specific objects specified in this Recommendation shall be used to manage the specific transport resources of SDH network elements, as related to the multiplex-section protection function. Implementations shall conform to both the management information defined in clauses 3 to 15 and the requirements identified in 5.2.

This Recommendation addresses the management of the automatic protection switching within the network element at the Multiplex Section. The management for multiplex-section protection is based on the protection function described in ITU-T G.803.

### 5.2.1 Generic SDH transmission protection functional requirements

The application specific management models for SDH systems are based on a generic protection model for transmission which satisfies the following common protection requirements:

- 1) Manage a group of protected resources together with their protecting resources as one protection group, where all members of the protection group in a network element may be configured for:
  - a) m:n or 1 + 1 type protection;
  - b) revertive or non-revertive type switching;
  - c) a specific wait-to-restore time (in the case of revertive systems).
- 2) Indicate the ability of the group of protection units as a whole to provide the protection switching function properly and to send a notification when a change in this operational state occurs.
- 3) Indicate the status of each individual protection unit such as automatic switch completed.
- 4) Send a notification, identifying the protection unit and protection group, when a protection switch event occurs. Specific notification requirements are application specific.
- 5) Send a notification when protection resources are added or removed on the NE.
- 6) For each protected or protecting resource, the ability to perform the following management operations:
  - a) invoke a manual protection request;
  - b) invoke a forced protection switch;
  - c) lockout a protection or working channel;
  - d) determine the operational state of the protection group;
  - e) indicate a resource as protecting or protected (although most but not all 1 + 1 systems are symmetrical with respect to their protection switching or management functionality). The equipment in the NE determines this operation and provides this indication;
  - f) ability to set the switch priority for protected resources in 1:n systems.

The generic information model for SDH protection management is provided by the **protectionGroup** and **protectionUnit** objects.

### 5.2.2 SDH multiplex-section specific functional requirements

The management information model for linear system multiplex-section protection provided in this Recommendation is based on the generic model and approach to protection, which satisfies the requirements described in 5.2.1. Additionally, the following SDH MS specific requirements exist:

- 1) Ability to configure the protection switch mode for all protection resources within a protection group as uni- or bidirectional.

- 2) Ability to send a notification of the protection status of each protected or protecting resource. The protection status value shall indicate the current switch request active or pending (in the case of automatic switch requests only) on any given protection unit (resource).
  - 3) Manage extra traffic as follows:
    - a) ability to explicitly suspend and resume extra traffic in a protection unit;
    - b) prevent extra traffic from being pre-empted by other switch requests;
    - c) allow Extra Traffic to be pre-empted by higher priority requests and allow Extra Traffic to be automatically re-established when the higher priority request is removed;
    - d) ability to change between modes b) and c).
  - 4) Send the following protection switch related notifications:
    - a) when a protected resource, having been switched to a protecting resource, is pre-empted by a higher priority request from the same or another protected resource (applicable in 1:n systems);
    - b) when a protected resource (unit) is switched onto a protecting resource;
    - c) when any switch is released;
    - d) when an auto-switch condition exists but cannot be served due to a higher priority request already being served.
  - 5) Ability to detect a mismatch between near and far-end protection group type configured values (1 + 1 or 1:n).
  - 6) Ability to invoke an exercise on a protected channel.
  - 7) Allow only one protecting resource.
  - 8) Store the most recent protection switch or exercise result, and provide a notification, against the associated group of protection resources as a whole, when a failure to perform the protection function is detected.
- With respect to ITU-T G.774 termination points which represent the protected (working channels) resources, the following requirements exist:
- 9) Provide a relationship between the termination points which represent the protected (working channels) and the termination point which represents the protecting (protection channel), and the termination point which reflects the reliable resource.
  - 10) In performing a protection switch, update the connectivity pointers of the affected termination points to indicate the new traffic flow.

The objects relevant to SDH MS Protection Switching are the following sub-classes:

**sdhMSProtectionGroup** and **sdhMSProtectionUnit**. Additionally, sub-classes of the termination point model are required. These are **protectedTTPSink**, **protectedTTPSource**, **protectedTTPBidirectional**, **unprotectedCTPSink**, **unprotectedCTPSource**, and **unprotectedCTPBidirectional**.

With respect to the creation/deletion of the protection management objects:

- 11) It is the responsibility of the NE to create and delete the objects related to protection management according to the make up and mode of the NE.

## 6 Managed Object Class Definitions

To allow SDH equipment to be represented in a consistent manner across the interface, the conditional package **crossConnectionObjectPointerPackage** in ITU-T M.3100 is made mandatory in this Recommendation. The following conditional packages inherited from ITU-T M.3100 shall

not be used when the SDH object classes defined in this Recommendation are instantiated:  
**ttpInstancePackage**, **ctpInstancePackage**, **networkLevelPackage**,  
**characteristicInformationPackage**, **channelNumberPackage**.

## 6.1 APS report record

```
apsReportRecord MANAGED OBJECT CLASS
  DERIVED FROM "Recommendation X.721 | ISO/IEC 10165-2": eventLogRecord;
  CHARACTERIZED BY
    apsReportRecordPkg PACKAGE
  BEHAVIOUR apsReportRecordBeh;
  ATTRIBUTES
    reportedProtectionUnit GET;;;
REGISTERED AS { g774-03MObjectClass 1 };
apsReportRecordBeh BEHAVIOUR
DEFINED AS
"An instance of the apsReportRecord object is created when a
protectionSwitchReportingNotification is generated. The protectionStatusParameter
must be included in the management extension.
";
```

## 6.2 Protected TTP bidirectional

```
protectedTTPBidirectional MANAGED OBJECT CLASS
  DERIVED FROM "Recommendation M.3100": trailTerminationPointBidirectional,
    protectedTTPSource,
    protectedTTPSink;
  CHARACTERIZED BY
    protectedTTPBidirectionalPkg PACKAGE
  BEHAVIOUR protectedTTPBidirectionalBeh;;;
REGISTERED AS { g774-03MObjectClass 2 };
protectedTTPBidirectionalBeh BEHAVIOUR
DEFINED AS
"The protectedTTPBidirectional object class is a class of objects that represents
the bidirectional protected resources in a protection system. If the SDH
bidirectional multiplex section protection switching function is present, this
object class shall be supported.
";
```

## 6.3 Protected TTP sink

```
protectedTTPSink MANAGED OBJECT CLASS
  DERIVED FROM "Recommendation M.3100": trailTerminationPointSink;
  CHARACTERIZED BY
    "Recommendation M.3100": crossConnectionPointerPackage,
    protectedTTPSinkPkg PACKAGE
  BEHAVIOUR protectedTTPSinkBeh;
  ATTRIBUTES
    protectedTTPId GET;;;
REGISTERED AS { g774-03MObjectClass 3 };
protectedTTPSinkBeh BEHAVIOUR
DEFINED AS
"The protectedTTPSink object class is a class of objects that represents the
protected resources in a protection system. An instance of this object class is
pointed to by the reliableResourcePointer attribute in an instance of the
protectionUnit object class. The crossConnectionObjectPointer attribute in an
instance of this object class points to its associated protectionUnit instance
which has the reliableResourcePointer attribute pointing back to the instance of
this object class. The upstreamConnectivityPointer in an instance of this object
class points to either null or its associated unprotected CTP object instance; it
indicates the actual signal flow, and when a signal is switched to another unit,
the value of the upstreamConnectivityPointer is updated. If the
```

**attributeValueChangeNotification** package is present, then a change in the value of the **supportedByObjectList** shall cause an **attributeValueChange** notification.  
 ";

## 6.4 Protected TTP source

```
protectedTTPSource MANAGED OBJECT CLASS
  DERIVED FROM "Recommendation M.3100": trailTerminationPointSource;
  CHARACTERIZED BY
    "Recommendation M.3100": crossConnectionPointerPackage,
    protectedTTPSourcePkg PACKAGE
  BEHAVIOUR protectedTTPSourceBeh;
  ATTRIBUTES
    protectedTTPIdGET;;;
REGISTERED AS { g774-03MObjectClass 4 };
protectedTTPSourceBeh BEHAVIOUR
DEFINED AS
"The protectedTTPSource object class is a class of objects that represents the
protected resources in a protection system. An instance of this object class is
pointed to by the reliableResourcePointer attribute in an instance of the
protectionUnit object class. The crossConnectionObjectPointer attribute in an
instance of this object class points to its associated protectionUnit object
instance which has the reliableResourcePointer attribute pointing back to the
instance of this object class. The downstreamConnectivityPointer in an instance
of this object class points to either null or its associated unprotected CTP
object instance(s); it indicates the actual signal flow, and when a signal is
switched to another unit, the pointer is updated. If the
attributeValueChangeNotification package is present, then a change in the value
of the supportedByObjectList shall cause an attributeValueChange notification.
";
```

## 6.5 Protection group

```
protectionGroupR1 MANAGED OBJECT CLASS
DERIVED FROM "Recommendation X.721 | ISO/IEC 10165-2":top;
CHARACTERIZED BY
  protectionGroupPkgR1 PACKAGE
  BEHAVIOUR protectionGroupR1Beh;
  ATTRIBUTES
    "Recommendation X.721 | ISO/IEC 10165-2":operationalState      GET,
    "Recommendation X.721 | ISO/IEC 10165-2":availabilityStatus    GET,
    protectionGroupId      GET,
    protectionGroupType    GET-REPLACE,
    revertive              REPLACE-WITH-DEFAULT
  DEFAULT VALUE SDHProtASN1.booleanTrueDefault      GET-REPLACE,
    "Recommendation M.3100":supportedByObjectList      GET,
    waitToRestoreTime    GET-REPLACE;
  ACTIONS
    invokeProtection,
    releaseProtection;
  NOTIFICATIONS
    protectionSwitchReportingR1,
    "Recommendation X.721 | ISO/IEC 10165-2":stateChange;;;
  CONDITIONAL PACKAGES
    "Recommendation M.3100":createDeleteNotificationsPackage
      PRESENT IF "an instance supports it",
    "Recommendation M.3100":attributeValueChangeNotificationPackage
      PRESENT IF "an instance supports it";
REGISTERED AS { g774-03MObjectClass 12 };

protectionGroupR1Beh BEHAVIOUR
  DEFINED AS
```

"A **protectionGroup** object instance contains zero or more **protectionUnit** objects for defining a protection switching relationship where one or more standby (i.e. backup) entities provide protection for one or more working (i.e. regular or preferred) entities.

The **invokeProtection** action can be used to request a lockout, a forced switch, or a manual switch (i.e. normal switch) on one or more **protectionUnit** instances contained in the **protectionGroup** object. The **releaseProtection** action can be used to release a lockout, a forced switch, or a manual switch (i.e. normal switch) on one or more **protectionUnit** instances contained in the **protectionGroup** object. The **protectionSwitchReporting** notification is emitted from the **protectionGroup** object to report any protection switch events, such as protection switching (forced switch, manual switch, or automatic switch), protection release (release of forced switch, manual switch, or automatic switch), lockout or release of lockout.

If the **attributeValueChangeNotification** package is present, then changes to the **protectionGroupType** attribute, the revertive attribute or the **waitToRestoreTime** attribute shall cause an **attributeValueChange** notification to be emitted. The **protectionGroupType** attribute shall have the value 'colon' when more than one **protectionUnit** is protected. Changing the value of this attribute between 'plus' and 'colon' is allowed when only one protected **protectionUnit** and one protecting **protectionUnit** are contained by the **protectionGroup**. The change from 'plus' to 'colon' is only allowed if the underlying resources support M:N protection.";

## 6.6 Protection unit

**protectionUnit** MANAGED OBJECT CLASS

DERIVED FROM "Recommendation X.721 | ISO/IEC 10165-2": top;

CHARACTERIZED BY

protectionUnitPkg PACKAGE

BEHAVIOUR protectionUnitBeh;

ATTRIBUTES

protectionUnitId GET,  
protecting GET,  
reliableResourcePointer GET,  
unreliableResourcePointer GET;;;

CONDITIONAL PACKAGES

priorityPkg PRESENT IF "an instance supports it",  
"Recommendation M.3100": attributeValueChangeNotificationPackage  
PRESENT IF "an instance supports it";

REGISTERED AS { g774-03MObjectClass 6 };

**protectionUnitBeh** BEHAVIOUR

DEFINED AS

"A **protectionUnit** object represents a protected (i.e. working, regular, or preferred) unit or a protecting (i.e. backup or standby) unit. For a protecting **protectionUnit**, the attribute **protecting** shall have the value TRUE. For a protected **protectionUnit**, the attribute **protecting** shall have the value FALSE. The value of the **unreliableResourcePointer** attribute points to an unreliable resource (e.g. equipment hardware or termination point) that is associated with the **protectionUnit** instance. The value of the **reliableResourcePointer** attribute points to a reliable resource (e.g. termination point) that is associated with the **protectionUnit** instance.

If the **attributeValueChangeNotificationPackage** is present, then changes to the **unreliableResourcePointer** attribute, the **priority** attribute or the **reliableResourcePointer** attribute shall cause an **attributeValueChange** notification to be emitted.

";

## 6.7 SDH multiplex-section protection group

```
sdhMSProtectionGroupR1 MANAGED OBJECT CLASS
  DERIVED FROM      protectionGroupR1;
  CHARACTERIZED BY
    sdhMSProtectionGroupR1Pkg PACKAGE
  BEHAVIOUR sdhMSProtectionGroupR1Beh;
  ATTRIBUTES
    protectionSwitchMode          GET-REPLACE;
  NOTIFICATIONS
    protectionSwitchReportingR1
    protectionStatusParameter;;;
  CONDITIONAL PACKAGES
    protectionMismatchStatusPkg
      PRESENT IF "the APS protocol is used",
    protectionSwitchExercisePkg
      PRESENT IF "an instance supports it";
REGISTERED AS { g774-03MObjectClass 13 };
```

```
sdhMSProtectionGroupR1Beh BEHAVIOUR
  DEFINED AS
```

"This object class is used specifically for representing a SDH multiplex-section protection group in a protection system. Only one protecting protection unit is allowed. The **protectionMismatchStatus** indicates a mismatch between the provisioned **protectionGroupType** of this protection group and the provisioned **protectionGroupType** of the far-end. It also indicates mismatch of uni-directional versus bi-directional switch provisioning between the two protection groups.";

## 6.8 SDH multiplex-section protection unit

```
sdhMSProtectionUnit MANAGED OBJECT CLASS
  DERIVED FROM      protectionUnit;
  CHARACTERIZED BY
    sdhMSProtectionUnitPkg PACKAGE
  BEHAVIOUR sdhMSProtectionUnitBeh;
  ATTRIBUTES
    channelNumber GET,
    protectionStatus          GET,
    reliableResourcePointer PERMITTED VALUES
SDHProtASN1.SDHMSResourcePointer,
    unreliableResourcePointer PERMITTED VALUES
SDHProtASN1.SDHMSResourcePointer;;;
  CONDITIONAL PACKAGES
    sdhPriorityPkg PRESENT IF "this is a 1:n system",
    lastAttemptResultPkg PRESENT IF "the APS protocol is used",
    extraTrafficControlPkg PRESENT IF "extra traffic may be suspended and
    resumed";
REGISTERED AS { g774-03MObjectClass 8 };
sdhMSProtectionUnitBeh BEHAVIOUR
  DEFINED AS
```

"This object class is specific to SDH multiplex section protection systems. Instances of this object class are used to represent a relationship between a **protectedTTP** and an **unprotectedCTP**. If this is a protecting protection unit, the **reliableResourcePointer** points to the **protectedTTP** for extra traffic or NULL if there is no extra traffic. The **channelNumber** attribute value represents the number of the channel used by the SDH MSP protocol, if any. If the **sdhMSProtectionUnit** is protecting, then the **channelNumber** attribute shall have the value 0. If the **sdhMSProtectionUnit** is protected, the **channelNumber** attribute shall have a value between 1 and 14. For Lockout of protecting unit, protected channels 1 to 14 are incapable of being carried on protection.

```
";
```

## 6.9 Unprotected CTP bidirectional

```
unprotectedCTPBidirectional MANAGED OBJECT CLASS
  DERIVED FROM "Recommendation M.3100":
connectionTerminationPointBidirectional,
  unprotectedCTPSource,
  unprotectedCTPSink;
  CHARACTERIZED BY
    unprotectedCTPBidirectionalPkg PACKAGE
  BEHAVIOUR unprotectedCTPBidirectionalBeh;;;
REGISTERED AS { g774-03MObjectClass 9 };
unprotectedCTPBidirectionalBeh BEHAVIOUR
DEFINED AS
"The unprotectedCTPBidirectional object class is a class of objects that
represents the unprotected resources in a protection system.
";
```

## 6.10 Unprotected CTP sink

```
unprotectedCTPSink MANAGED OBJECT CLASS
  DERIVED FROM "Recommendation M.3100": connectionTerminationPointSink;
  CHARACTERIZED BY
    "Recommendation M.3100": crossConnectionPointerPackage,
    unprotectedCTPSinkPkg PACKAGE
  BEHAVIOUR unprotectedCTPSinkBeh;
  ATTRIBUTES
    unprotectedCTPId GET;;;
REGISTERED AS { g774-03MObjectClass 10 };
unprotectedCTPSinkBeh BEHAVIOUR
DEFINED AS
"The unprotectedCTPSink object class is a class of objects that represents the
unprotected resources in a protection system. An instance of this object class is
pointed to by the unreliableResourcePointer attribute in an instance of the
protectionUnit object class (or its subclasses). The crossConnectionObjectPointer
attribute in an instance of this object class points to its associated
protectionUnit object instance which has the unreliableResourcePointer attribute
pointing back to the instance of this object class.
";
```

## 6.11 Unprotected CTP source

```
unprotectedCTPSource MANAGED OBJECT CLASS
  DERIVED FROM "Recommendation M.3100": connectionTerminationPointSource;
  CHARACTERIZED BY
    "Recommendation M.3100": crossConnectionPointerPackage,
    unprotectedCTPSourcePkg PACKAGE
  BEHAVIOUR unprotectedCTPSourceBeh;
  ATTRIBUTES
    unprotectedCTPId GET;;;
REGISTERED AS { g774-03MObjectClass 11 };
unprotectedCTPSourceBeh BEHAVIOUR
DEFINED AS
"The unprotectedCTPSource object class is a class of objects that represents the
unprotected resources in a protection system. An instance of this object class is
pointed to by the unreliableResourcePointer attribute in an instance of the
protectionUnit object class (or its subclasses). The crossConnectionObjectPointer
attribute in an instance of this object class points to its associated
protectionUnit object instance which has the reliableResourcePointer attribute
pointing back to the instance of this object class.
";
```

## 7 Packages

### 7.1 Extra traffic control

```
extraTrafficControlPkg PACKAGE
  BEHAVIOUR extraTrafficControlPkgBeh;
  ATTRIBUTES
    "Recommendation X.721 | ISO/IEC 10165-2": administrativeState
    GET-REPLACE;
REGISTERED AS { g774-03Package 1 };
extraTrafficControlPkgBeh BEHAVIOUR
DEFINED AS
"Attribute administrativeState is used to suspend or resume extra traffic on the
protecting channel. When in the Locked state, no extra traffic is carried on the
protecting channel, however, this does not prevent protected channel traffic from
being switched to the protecting channel. When unlocked, extra traffic is resumed
on the protecting channel as long as there is no request from a protected channel
of higher priority than on the protecting channel.
";
```

### 7.2 Last attempt result

```
lastAttemptResultPkg PACKAGE
  ATTRIBUTES
    lastAttemptResult GET;
REGISTERED AS { g774-03Package 2 };
```

### 7.3 Protection Switch Exercise

```
protectionSwitchExercisePkg PACKAGE
  ACTIONS
    invokeExercise;
REGISTERED AS { g774-03Package 3 };
```

### 7.4 Protection Mismatch Status

```
protectionMismatchStatusPkg PACKAGE
  ATTRIBUTES
    protectionMismatchStatus GET;
REGISTERED AS { g774-03Package 4 };
```

### 7.5 Priority

```
priorityPkg PACKAGE
  ATTRIBUTES
    priority GET-REPLACE;
REGISTERED AS { g774-03Package 5 };
```

### 7.6 SDH Priority

```
sdhPriorityPkg PACKAGE
  ATTRIBUTES
    sdhPriority PERMITTED VALUES SDHProtASN1.SDHMSPriority GET-REPLACE;
REGISTERED AS { g774-03Package 6 };
```

## 8 Attributes

### 8.1 Channel Number

```
channelNumber ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.Integer;
    MATCHES FOR              EQUALITY, ORDERING;
    BEHAVIOUR channelNumberBeh;
REGISTERED AS { g774-03Attribute 1 };
channelNumberBeh BEHAVIOUR
DEFINED AS
"This attribute indicates the channel number associated with a protectionUnit.
";
```

### 8.2 Last attempt result

```
lastAttemptResult ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.LastAttemptResult;
    MATCHES FOR              EQUALITY;
    BEHAVIOUR lastAttemptResultBeh;
REGISTERED AS { g774-03Attribute 2 };
lastAttemptResultBeh BEHAVIOUR
DEFINED AS
"The value of the last exercise result or the result of a protection group/unit diagnostic or switch attempt which performs at least the same functionality as an exercise, is available from his attribute. If a failure occurs, the availabilityStatus of the protectionGroup object will be set to degraded. The successful completion of a protection group/unit diagnostic or switch attempt which performs at least the same functionality as an exercise causes the availabilityStatus attribute to be set to NULL (i.e. available), and the lastAttemptResult value is set to success.
";
```

### 8.3 Priority

```
priority ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.Integer;
    MATCHES FOR              EQUALITY, ORDERING;
    BEHAVIOUR priorityBeh;
REGISTERED AS { g774-03Attribute 3 };
priorityBeh BEHAVIOUR
DEFINED AS
"This attribute specifies the priority of the service (e.g. traffic) carried on the resource associated with the protected protectionUnit instance. Valid values for this attribute are integers, where the value 1 indicates the highest priority, and a larger value indicates a lower priority. For a protecting protectionUnit, the value of this attribute indicates the priority of choice of the protecting protectionUnit relative to other available protecting protectionUnit(s) within the same protectionGroup. The lower the value, the more preferred the protectionUnit is relative to other protectionUnits.
";
```

### 8.4 Protected trail termination point identifier

```
protectedTTPIId ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.NameType;
    MATCHES FOR              EQUALITY, ORDERING, SUBSTRINGS;
    BEHAVIOUR protectedTTPIIdBeh;
REGISTERED AS { g774-03Attribute 4 };
protectedTTPIIdBeh BEHAVIOUR
```

#### DEFINED AS

"This attribute is used as an RDN for naming instances of the **protectedTTP** object classes. If the string choice of the syntax is used, then matching on substrings is permitted. If the number choice for the syntax is used, then matching on ordering is permitted.

";

### 8.5 Reported protection unit

```
reportedProtectionUnit ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.RelativeDistinguishedName;
    MATCHES FOR    EQUALITY;
    BEHAVIOUR protectionGroupIdBeh;
REGISTERED AS { g774-03Attribute 5 };
```

### 8.6 Protection group identifier

```
protectionGroupId ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.NameType;
    MATCHES FOR    EQUALITY, ORDERING, SUBSTRINGS;
    BEHAVIOUR protectionGroupIdBeh;
REGISTERED AS { g774-03Attribute 6 };
```

protectionGroupIdBeh BEHAVIOUR

#### DEFINED AS

"The **protectionGroupId** attribute is an attribute type whose distinguished value can be used as an RDN when naming an instance of the **protectionGroup** object class. If the string choice of the syntax is used, then matching on substrings is permitted. If the number choice for the syntax is used, then matching on ordering is permitted.

";

### 8.7 Protection group type

```
protectionGroupType ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.ProtectionGroupType;
    MATCHES FOR    EQUALITY;
    BEHAVIOUR protectionGroupTypeBeh;
REGISTERED AS { g774-03Attribute 7 };
```

protectionGroupTypeBeh BEHAVIOUR

#### DEFINED AS

"This attribute specifies whether the protection scheme used is 1 + 1 (plus) or M:N (colon). M:N includes the cases where M = 1 and/or N = 1.

";

### 8.8 Protection mismatch status

```
protectionMismatchStatus ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.ProtectionMismatchStatus;
    MATCHES FOR    EQUALITY;
    BEHAVIOUR protectionMismatchStatusBeh;
REGISTERED AS { g774-03Attribute 8 };
```

protectionMismatchStatusBeh BEHAVIOUR

#### DEFINED AS

"This attribute indicates a mismatch between the local and far-end provisioned values for the **protectionGroupType** attribute and has a separate indication for a mismatch between the local and far-end provisioned values for the **protectionSwitchMode** attribute.

";

## 8.9 Protection status

**protectionStatus** ATTRIBUTE  
WITH ATTRIBUTE SYNTAX SDHProtASN1.ProtectionStatus;  
MATCHES FOR EQUALITY, SET-COMPARISON,  
SET-INTERSECTION;

BEHAVIOUR protectionStatusBeh;  
REGISTERED AS { g774-03Attribute 9 };  
**protectionStatusBeh** BEHAVIOUR  
DEFINED AS

"This attribute is used to indicate the status of the protection switch in a **protectionUnit** instance. This attribute is set-valued because some requests are allowed to be pending. The following rule shall be followed: Only one of the values **lockout**, **forcedSwitch**, or **manualSwitch** can be present at the same time, either local or remote. It is also possible to have two or more pending automatic switch requests. The **protectionStatus** attribute of a protection Unit which provides protection is used to hold the protection request which is actually performed on that **protectionUnit**.

Locally invoked management operations (e.g. manual, forced, lockout switch completions) can be overridden at the near end or the far end, but may only be released at the near end.

Single-ended systems keep the status of local and far-end switch requests as separate entities in the **protectionStatus** attribute.

The remainder of this behaviour provides the allowable **protectionStatus** attribute values for protected and protecting units for both revertive and non-revertive systems.

The following allowable **protectionStatus** values are associated with each protected unit:

- **No Request** - No switch request is present on the unit.
- **Manual Switch to Protecting Complete** - The unit has completed a Manual Switch.
- **Release failed** - A switch has been released or pre-empted and a timeout occurs while waiting for a release of associated bridges, or the near-end switch.
- **Automatic Switch (SF) Pending** - The unit has a Signal Fail condition present and the protecting unit is unavailable.
- **Automatic Switch (SD) Pending** - The unit has a Signal Degrade condition present and the protecting unit is unavailable.
- **Automatic Switch (SF) Complete** - The unit has completed an Automatic Switch to the protecting unit due to a Signal Fail condition.
- **Automatic Switch (SD) Complete** - The unit has completed an Automatic Switch to the protecting unit due to a Signal Degrade condition.
- **Automatic Switch (SF) Present, Operate failed** - An automatic switch (SF) request is in progress and a time-out occurs while waiting for completion.
- **Automatic Switch (SD) Present, Operate failed** - An automatic switch (SD) request is in progress and a time-out occurs while waiting for completion.
- **Force Switch Complete, Automatic Switch (SF) Pending** - The unit has completed a Force Switch. Additionally, the unit has an automatic switch (SF) pending.
- **Force Switch Complete, Automatic Switch (SD) Pending** - The unit has completed a Force Switch. Additionally, the unit has an automatic switch (SD) pending.
- **Automatic Switch Complete, Wait-to-Restore** - The unit has completed an Automatic Switch to the protecting unit.
- **Force Switch Complete** - The unit has completed a Force Switch to the protecting unit.
- **Protected Unit Lockout Completed** - The unit has been locked out from the protecting unit.
- **Protected Unit Lockout complete, Operate Failed** - The unit has been locked out from the protecting unit, and, the previously completed switch could not be released within the expected time-out. When the switch is released, the operate failed status is removed.

Additionally, the non-revertive protected protection unit has the following status values:

- **Do Not Revert** - The protected unit has been switched to the protecting unit and the request to do so has been released. The switch to the protecting unit is maintained.
- **Manual Switch to Protected Unit Complete** - The unit has completed a Manual Switch from the protecting unit to the protected unit.
- **Force Switch to Protected Unit Complete** - The unit has completed a Force Switch from the protecting unit to the protected unit.
- **Automatic Switch (SF) to Protected Unit Complete** - The protecting unit has a Signal Fail condition present and traffic is now being carried on the protected unit.
- **Automatic Switch (SD) to Protected Unit Complete** - The protecting unit has a Signal Degrade condition present and traffic is now being carried on the protected unit.
- **Automatic Switch (SD) to Protected Unit Complete, Signal Degrade Present** - The protecting unit has a Signal Degrade condition present and traffic is now being carried on the protected unit. Additionally, the protected unit has a Signal Degrade condition present.
- **Automatic Switch (SF) to Protected Unit Complete, Signal Degrade Present** - The protecting unit has a Signal Fail condition present and traffic is now being carried on the protected unit. Additionally, the protected unit has a Signal Degrade condition present.
- **Force Switch from Protecting Unit Complete, Automatic Switch (SF) Pending** - The unit has completed a Force Switch from the protecting unit to the protected unit. Additionally, the protected unit has an automatic switch (SF) condition present.
- **Force Switch from Protecting Unit Complete, Automatic Switch (SD) Pending** - The unit has completed a Force Switch from the protecting unit to the protected unit. Additionally, the protected unit has an automatic switch (SD) condition present.

The following allowable **protectionStatus** values are associated with each protecting unit:

- **No Request** - No request is present on the protecting unit.
- **Manual Switch to Protecting Unit Complete** - The protected unit has completed a Manual Switch.
- **Automatic Switch Complete (SF) to Protecting Unit** - The protected unit has completed an automatic switch (SF) to the protecting unit.
- **Automatic Switch Complete (SD) to Protecting Unit** - The protected unit has completed an automatic switch (SD) to the protecting unit.
- **Automatic Switch Complete (SD) to Protecting Unit, Protecting Unit Signal Degraded** - The protected unit has completed an automatic switch to the protecting unit. Additionally, the protecting unit has a Signal Degrade condition present. This applies to 1:n systems only.
- **Automatic Switch Complete (SF) to Protecting Unit, Protecting Unit Signal Degraded** - The protected unit has completed an automatic switch to the protecting unit. Additionally, the protecting unit has a Signal Degrade condition present. This applies to 1:n systems only.
- **Protecting Unit SD Present** - The protecting unit has a Signal Degrade condition present. This state may also be a result of invalid or toggling APS byte values. This applies to 1:n systems only.
- **Protecting Unit SF Present** - The protecting unit has a Signal Fail condition present. This state may also be a result of invalid or toggling APS byte values. This applies to 1:n systems only.
- **Force Switch Complete to Protecting Unit** - The unit has completed a Force Switch of a protected unit to the protecting unit.
- **Force Switch Complete to Protecting Unit, SD Present on Protecting Unit** - The unit has completed a Force Switch of a protected unit to the protecting unit. Additionally, there is a Signal Degrade present on the protecting unit.

- **Force Switch Complete to Protecting, SF Present on Protecting Unit** - The unit has completed a Force Switch of a protected unit to the protecting unit. Additionally, there is a Signal Fail (1 + 1 unidirectional systems only) present on the protecting unit.
- **Protecting Unit Locked Out** - The protecting unit has been locked out.
- **Protecting Unit Locked Out, Release Failed** - A release of a lockout is in progress and a timeout occurs waiting for the lockout condition to clear. Additionally, the non-revertive protecting unit has the following values:
  - **Do Not Revert** - The protected unit has been switched to the protecting unit and the request to do so has been released. The switch to the protecting unit is maintained.
  - **Manual Switch to Protected Unit Complete** - The unit has completed a Manual Switch from the protecting unit to the protected unit.
  - **Force Switch to Protected Unit Complete** - The protecting unit has completed a forced switch to the protected unit.
  - **Force Switch to Protected Unit Complete, Protecting Unit Signal Degraded** - The protecting unit has completed a forced switch to the protected unit. Additionally, there is a Signal Degrade condition on the protecting unit.
  - **Force Switch to Protected Unit Complete, Protecting Unit Signal Failed** - The protecting unit shows a forced switch to the protected unit. Additionally, there is a Signal Fail condition on the protecting unit.
  - **Automatic Switch (SF) to Protected Unit Complete** - The protecting unit has a Signal Fail condition present and traffic is now being carried on the protected unit.
  - **Automatic Switch (SD) to Protected Unit Complete** - The protecting unit has a Signal Degrade condition present and traffic is now being carried on the protected unit.
  - **Automatic Switch Complete (SD) to Protecting, Automatic Switch (SD) to Protected Unit Pending** - The protected unit has completed an automatic switch to the protecting unit. Additionally, the protecting unit has a Signal Degrade condition present.
  - **Automatic Switch Complete (SF) to Protecting, Automatic Switch (SD) to Protected Unit Pending** - The protected unit has completed an automatic switch to the protecting unit. Additionally, the protecting unit has a Signal Degrade condition present.

APS timeout detected by the exerciser, or, during an attempt to invoke a manual or forced switch will not be indicated as APS failure (operate or release fail) in the **protectionStatus** attribute. Instead, the **actionReply** for the invoked action will report this. Additionally, attribute **lastAttemptResult** will provide a record of the failure, until a successful exercise or protection switch causes this attribute to be cleared.

";

## 8.10 Protection switch mode

```

protectionSwitchMode ATTRIBUTE
  WITH ATTRIBUTE SYNTAX SDHProtASN1.ProtectionSwitchMode;
  MATCHES FOR EQUALITY;
  BEHAVIOUR protectionSwitchModeBeh;
REGISTERED AS { g774-03Attribute 10 };
protectionSwitchModeBeh BEHAVIOUR
DEFINED AS

```

"This attribute specifies whether protection switching is done on a unidirectional or bidirectional basis.

";

## 8.11 Protection unit identifier

```
protectionUnitId ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.NameType;
    MATCHES FOR    EQUALITY, ORDERING, SUBSTRINGS;
    BEHAVIOUR protectionUnitIdBeh;
REGISTERED AS { g774-03Attribute 11 };
protectionUnitIdBeh BEHAVIOUR
DEFINED AS
```

"The **protectionUnitId** attribute is an attribute type whose distinguished value can be used as an RDN when naming an instance of the **protectionUnit** object class. If the string choice of the syntax is used, then matching on substrings is permitted. If the number choice for the syntax is used, then matching on ordering is permitted.

```
";
```

## 8.12 Protecting

```
protecting ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.Boolean;
    MATCHES FOR    EQUALITY;
    BEHAVIOUR protectingBeh;
REGISTERED AS { g774-03Attribute 12 };
protectingBeh BEHAVIOUR
DEFINED AS
```

"This attribute specifies the type of the **protectionUnit**. A value of TRUE indicates that the **protectionUnit** is a protecting (i.e. backup or standby) unit. A value of FALSE indicates that the **protectionUnit** is a protected (i.e. a regular, working, or preferred) unit.

```
";
```

## 8.13 Reliable resource pointer

```
reliableResourcePointer ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.ResourcePointer;
    MATCHES FOR    EQUALITY;
    BEHAVIOUR reliableResourcePointerBeh;
REGISTERED AS { g774-03Attribute 13 };
reliableResourcePointerBeh BEHAVIOUR
DEFINED AS
```

"The value of the **reliableResourcePointer** attribute points to the reliable resource(s) (e.g. termination point) that is/are associated with the **protectionUnit** instance.

```
";
```

## 8.14 Revertive

```
revertive ATTRIBUTE
    WITH ATTRIBUTE SYNTAX    SDHProtASN1.Boolean;
    MATCHES FOR    EQUALITY;
    BEHAVIOUR revertiveBeh;
REGISTERED AS { g774-03Attribute 14 };
revertiveBeh BEHAVIOUR
DEFINED AS
```

"This attribute indicates whether the protection scheme is revertive or not. If the value of this attribute is TRUE, the traffic is returned to the protected **protectionUnit** instance that initiated the switch after the fault clears and the **waitToRestoreTime** interval (if any) has expired. If the value of this attribute is FALSE, then after the fault has cleared, traffic does not revert to the **protectionUnit** that initiated the switch.

```
";
```

## 8.15 SDH Priority

```
sdhPriority ATTRIBUTE
  WITH ATTRIBUTE SYNTAX SDHProtASN1.Integer;
  MATCHES FOR EQUALITY;
  BEHAVIOUR sdhPriorityBeh;
REGISTERED AS { g774-03Attribute 15 };
sdhPriorityBeh BEHAVIOUR
DEFINED AS
"SDH priority may be High or Low for protected protection units. This is intended
for prioritizing SD and SF conditions on 1:n systems.
";
```

## 8.16 Unprotected connection termination point identifier

```
unprotectedCTPId ATTRIBUTE
  WITH ATTRIBUTE SYNTAX SDHProtASN1.NameType;
  MATCHES FOR EQUALITY, ORDERING, SUBSTRINGS;
  BEHAVIOUR unprotectedCTPIdBeh;
REGISTERED AS { g774-03Attribute 16 };
unprotectedCTPIdBeh BEHAVIOUR
DEFINED AS
"This attribute is used as an RDN for naming instances of the unprotectedCTP
object classes. If the string choice of the syntax is used, then matching on
substrings is permitted. If the number choice for the syntax is used, then
matching on ordering is permitted.
";
```

## 8.17 Unreliable resource pointer

```
unreliableResourcePointer ATTRIBUTE
  WITH ATTRIBUTE SYNTAX SDHProtASN1.ResourcePointer;
  MATCHES FOR EQUALITY;
  BEHAVIOUR unreliableResourcePointerBeh;
REGISTERED AS { g774-03Attribute 17 };
unreliableResourcePointerBeh BEHAVIOUR
DEFINED AS
"The value of the unreliableResourcePointer attribute points to the unreliable
resource(s) (e.g. equipment hardware or termination point) that is/are associated
with the protectionUnit instance.
";
```

## 8.18 Wait to restore time

```
waitToRestoreTime ATTRIBUTE
  WITH ATTRIBUTE SYNTAX SDHProtASN1.Integer;
  MATCHES FOR EQUALITY, ORDERING;
  BEHAVIOUR waitToRestoreTimeBeh;
REGISTERED AS { g774-03Attribute 18 };
waitToRestoreTimeBeh BEHAVIOUR
DEFINED AS
"This attribute specifies the amount of time, in seconds, to wait after a fault
clears before restoring traffic to the protected protectionUnit that initiated
the switching.
";
```

## 8.19 Notified protection unit

```
notifiedProtectionUnit ATTRIBUTE
  WITH ATTRIBUTE SYNTAX SDHProtASN1.ProtectionUnit;
  MATCHES FOR EQUALITY;
REGISTERED AS { g774-03Attribute 19 };
```

## 9 Actions

### 9.1 Invoke exercise

```
invokeExercise ACTION
  BEHAVIOUR invokeExerciseBeh;
  MODE CONFIRMED;
  WITH INFORMATION SYNTAX SDHProtASN1.InvokeExerciseArg;
  WITH REPLY SYNTAX SDHProtASN1.InvokeExerciseReply;
REGISTERED AS { g774-03Action 1 };
invokeExerciseBeh BEHAVIOUR
DEFINED AS
```

"The **invokeExercise** action can be used to request a protection exercise routine to be performed on one or more **protectionUnit** instances contained in the **protectionGroup** object.

The action argument contains indications of the protected and protecting units to which the request applies. If a protecting unit is identified in the **protectedUnits** field, or if a protected unit is identified in the **protectingUnits** field, the action fails.

The **protectionEntity** field may be absent, indicating that the request applies to all contained protection units.

While an exercise is in progress, the value of the **protectionStatus** attribute shall continue to indicate **No Request**. When an exercise routine has completed for any **protectionUnit** instances, the **lastAttemptResult** attribute is updated to reflect pass or fail for each exercised protection unit.

";

### 9.2 Invoke protection

NOTE – The definition of Lockout, Forced Switch, and Manual Switch is provided in ITU-T G.783.

```
invokeProtection ACTION
  BEHAVIOUR invokeProtectionBeh;
  MODE CONFIRMED;
  PARAMETERS invokeProtectionError;
  WITH INFORMATION SYNTAX SDHProtASN1.InvokeProtectionArg;
REGISTERED AS { g774-03Action 2 };
invokeProtectionBeh BEHAVIOUR
DEFINED AS
```

"The **invokeProtection** action can be used to request a lockout, a forced switch, or a manual (i.e. normal switch) on one or more **protectionUnit** instances contained in the **protectionGroup** object.

The action argument contains a request (Forced Switch, Manual Switch, or Lockout) and indications of the protected and protecting units to which the request applies. If a protecting unit is identified in the **protectedUnits** field, or if a protected unit is identified in the **protectingUnits** field, the action fails.

If the request is Forced Switch or Manual Switch, the **protectedUnits** field shall identify one or more protection units. If only one unit is identified in the **protectedUnits** field, and there is only one protecting unit in the protection group, the **protectingUnits** field may be omitted. If the **protectingUnits** field is present, it shall identify the same number of units as the **protectedUnits** field. If the request is Lockout, the **protectionEntity** field may be absent, indicating that the request applies to all contained protection units. If the **protectionEntity** field is present, any number of protection units may be

identified in the **protectedUnits** and/or **protectingUnits** field, and either field may be absent.

For a Lockout request, the specified protected units and/or protecting units are locked out.

For requests which cannot be completed, either because the request is the protecting unit is serving a request of higher priority (in the error parameter of the CMIP APDU, reason: pre-empted), or failure occurs (failure), or timeout occurs (timeout), the reply shall indicate why the request could not be completed, and the request shall not be made pending. The CMIP error APDU contains the failure reasons.

";

### 9.3 Release protection

```
releaseProtection ACTION
    BEHAVIOUR releaseProtectionBeh;
    MODE CONFIRMED;
    PARAMETERS releaseProtectionError;
    WITH INFORMATION SYNTAX SDHProtASN1.ReleaseProtectionArg;
REGISTERED AS { g774-03Action 3 };
releaseProtectionBeh BEHAVIOUR
DEFINED AS
```

"The **releaseProtection** action can be used to release a lockout, a forced switch, or a manual (i.e. normal switch) on one or more **protectionUnit** instances contained in the **protectionGroup** object.

The action argument contains a request (Forced Switch, Manual Switch, or Lockout) and indications of the protected and protecting units to which the request applies. If a protecting unit is identified in the **protectedUnits** field, or if a protected unit is identified in the **protectingUnits** field, the action fails.

If the request is Forced Switch or Manual Switch, the **protectedUnits** field shall identify one or more protection units, and the **protectingUnits** field shall be omitted. For each identified protected unit, if it is not switched to a protecting unit, the action fails.

If the request is Lockout, the **protectionEntity** field may be absent, indicating that the request applies to all contained protection units. If the **protectionEntity** field is present, any number of protection units may be identified in the **protectedUnits** and/or **protectingUnits** field, and either field may be absent.

For a Lockout request, the specified protected units and/or protecting units are no longer locked out. That is, the protected units are now under protection and the protecting units are now capable of providing protection. For release requests which cannot be completed, the reply shall indicate why the request could not be completed.

";

## 10 Notifications

### Revisions that require re-registration

This clause provides replacement notification definitions for the existing ITU-T G.774.3 (1994). Any notification replaced by one in this clause is considered to be deprecated. The reason for the replacement of a notification is as follows:

- The replaced action is faulty and must be fixed.

In each case where a notification is replaced, the new notification will be registered within this Recommendation. The textual label for the notification will be revised to include the text "R1". For example in "protectionSwitchReporting", the revised label will become "protectionSwitchReportingR1".

Below is a table of notifications deprecated from ITU-T G.774.3 (1994) and the G.774.3 notifications which replace them:

protectionSwitchReporting

protectionSwitchReportingR1

## 10.1 Protection Switch Reporting

```

protectionSwitchReportingR1 NOTIFICATION
  BEHAVIOUR protectionSwitchReportingR1Beh;
  WITH INFORMATION SYNTAX SDHProtASN1.ProtectionSwitchReportingInfo
  AND ATTRIBUTE IDS
    protectingUnitreportedProtectionUnit,
    additionalInfo"Recommendation X.721": additionalInformation;
REGISTERED AS { g774-03Notification 2 };

```

```

protectionSwitchReportingR1Beh BEHAVIOUR
DEFINED AS
"The protectionSwitchReporting notification is emitted from the protectionGroup
object to report any protection switch events.";

```

## 11 Parameters

### 11.1 Invoke Protection Error

```

invokeProtectionError PARAMETER
  CONTEXT SPECIFIC-ERROR;
  WITH SYNTAX SDHProtASN1.InvokeProtectionError;
  BEHAVIOUR invokeProtectionErrorBeh;
REGISTERED AS { g774-03Parameter 1 };
invokeProtectionErrorBeh BEHAVIOUR
DEFINED AS

```

"This parameter is included in the error parameter of the CMIP APDU when the invoke protection action fails. The pre-empted choice means that a higher priority switch request exists on the protecting protection unit. The failure choice indicates that the request has not been performed due to an abnormal condition on the protection system. The timeout choice indicates that the protection switch has not been performed in the required time frame.

";

### 11.2 Release Protection Error

```

releaseProtectionError PARAMETER
  CONTEXT SPECIFIC-ERROR;
  WITH SYNTAX SDHProtASN1.ReleaseProtectionError;
  BEHAVIOUR releaseProtectionErrorBeh;
REGISTERED AS { g774-03Parameter 2 };
releaseProtectionErrorBeh BEHAVIOUR
DEFINED AS

```

"This parameter is included in the error parameter of the CMIP APDU when the release protection action fails. The failure choice indicates that the request has not been performed due to an abnormal condition on the protection system. The timeout choice indicates that the protection switch has not been performed in the required time frame.

";

## 11.3 Protection Status Parameter

protectionStatusParameter PARAMETER

CONTEXT EVENT-INFO;

WITH SYNTAX SDHProtASN1.ProtectionStatusParameter;

BEHAVIOUR protectionStatusParameterBeh;

REGISTERED AS { g774-03Parameter 3 };

protectionStatusParameterBeh BEHAVIOUR

DEFINED AS

"This parameter is included in the additional info parameters of the protection switching reporting notification.

This notification is sent by the protection group according to the following rules. There are several cases:

- The switch from protected to protecting or protecting to protected has been done without pre-empting an existing switch. In this case the old and new values of the Protection Status attribute of the protecting channel shall be reported in the notification by means of the **oldProtectionStatus** and **newProtectionStatus** parameters respectively.
- A switch is preformed by pre-empting an existing one. In this case the old and new values of the Protection Status attribute of the protecting channel shall be reported in the notification by means of the **oldProtectionStatus** and **newProtectionStatus** parameters respectively.
- An auto-switch condition exists on a channel but the auto-switch cannot be served due to the unavailability of the channel that otherwise protects it. In this case the **oldProtectionStatus** and **newProtectionStatus** parameters refer to the protection status attribute value of the channel on which the autoswitch condition arises. The exception is when the channel is already forced or locked out, in which case no notification is sent.
- A working channel (protected unit) has been locked out or released from lockout without modifying any existing switch. In this case the **oldProtectionStatus** and **newProtectionStatus** parameters refer to the protection status attribute value of the working channel which has been locked out.
- A protection channel (protecting unit) has been locked out or release from lockout without modifying the existing switch. In this case the **oldProtectionStatus** and **newProtectionStatus** parameters refer to the protection status attribute value of the protection channel which has been locked out.
- The **protectionSwitchReporting** is not sent when the automatic switch condition is toggling between SD, SF and WTR condition. While in the lockout of forced switch state no notification is sent except for ending of release failure.

";

## 12 Name Bindings

### Revisions that require re-registration

This clause provides replacement namebinding definitions for the existing ITU-T G.774.3 (1994). Any namebinding replaced by one in this clause is considered to be deprecated. The reasons for the replacement of a namebinding are as follows:

- 1) The replaced namebinding is faulty and must be fixed.
- 2) The replaced namebinding refers to a superior managed object class which has been re-registered in this or another Recommendation.
- 3) The replaced namebinding refers to a subordinate managed object class which has been re-registered in this or another Recommendation.
- 4) The replaced namebinding refers to a naming attribute which has been re-registered in this or another Recommendation.

In each case where a namebinding is replaced, the new namebinding will be registered within this Recommendation. The textual label for the namebinding will be revised to include the text "R1". For example, in the namebinding "protectionGroup-managedElement", the revised label will become namebinding "protectionGroupR1-managedElement". Note the "R1" is placed immediately following the revised class which impacts the namebinding.

Below is a table of namebindings deprecated from Recommendation G.774.3 (1994) and the G.774.3 namebindings which replace them:

*Deprecated G.774.3 (1994) Namebindings*

protectionGroup-managedElement  
protectionUnit-protectionGroup

*Replacement G.774.3 Namebindings*

protectionGroupR1-managedElement  
protectionUnit-protectionGroupR1

## 12.1 Protected Trail Termination Point

**protectedTTPBidirectional-sdhNE NAME BINDING**

SUBORDINATE OBJECT CLASS protectedTTPBidirectional;  
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774": sdhNE;  
WITH ATTRIBUTE protectedTTPId;  
BEHAVIOUR protectedTTPBidirectional-sdhNEBeh;

REGISTERED AS { g774-03NameBinding 1 };

**protectedTTPBidirectional-sdhNEBeh BEHAVIOUR**

DEFINED AS

"The subordinate managed objects are instantiated when the multiplex section protection switching function is present. Instances of this object class may also be instantiated when other types of protection switching functions, such as path protection, are present.

";

**protectedTTPSink-sdhNE NAME BINDING**

SUBORDINATE OBJECT CLASS protectedTTPSink;  
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774": sdhNE;  
WITH ATTRIBUTE protectedTTPId;  
BEHAVIOUR protectedTTPSink-sdhNEBeh;

REGISTERED AS { g774-03NameBinding 2 };

**protectedTTPSink-sdhNEBeh BEHAVIOUR**

DEFINED AS

"The subordinate managed objects are instantiated when the multiplex section protection switching function is present. Instances of this object may also be instantiated when other types of protection switching functions, such as path protection, are present.

";

**protectedTTPSource-sdhNE NAME BINDING**

SUBORDINATE OBJECT CLASS protectedTTPSource;  
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774": sdhNE;  
WITH ATTRIBUTE protectedTTPId;  
BEHAVIOUR protectedTTPSource-sdhNEBeh;

REGISTERED AS { g774-03NameBinding 3 };

**protectedTTPSource-sdhNEBeh BEHAVIOUR**

DEFINED AS

"The subordinate managed objects are instantiated when the multiplex section protection switching function is present. Instances of this object class may also be instantiated when other types of protection switching functions, such as path protection, are present.

";

## 12.2 Protection Group

```
protectionGroupR1-managedElement NAME BINDING
  SUBORDINATE OBJECT CLASS protectionGroupR1 AND SUBCLASSES;
  NAMED BY SUPERIOR OBJECT CLASS
  "Recommendation M.3100":managedElement AND SUBCLASSES;
  WITH ATTRIBUTE protectionGroupId;
REGISTERED AS { g774-03NameBinding 12 };
```

## 12.3 Aug

```
augBidirectional-protectedTTPBidirectional NAME BINDING
  SUBORDINATE OBJECT CLASS "Recommendation G.774": augBidirectional;
  NAMED BY SUPERIOR OBJECT CLASS protectedTTPBidirectional;
  WITH ATTRIBUTE "Recommendation G.774": augId;
  BEHAVIOUR augBidirectional-protectedTTPBidirectionalBeh;
REGISTERED AS { g774-03NameBinding 5 };
augBidirectional-protectedTTPBidirectionalBeh BEHAVIOUR
DEFINED AS
"The subordinate managed objects are instantiated when the multiplex-section
protection switching function is present.
";
augSink-protectedTTPSink NAME BINDING
  SUBORDINATE OBJECT CLASS "Recommendation G.774": augSink;
  NAMED BY SUPERIOR OBJECT CLASS protectedTTPSink;
  WITH ATTRIBUTE "Recommendation G.774": augId;
  BEHAVIOUR augSink-protectedTTPSinkBeh;
REGISTERED AS { g774-03NameBinding 6 };
augSink-protectedTTPSinkBeh BEHAVIOUR
DEFINED AS
"The subordinate managed objects are instantiated when the multiplex-section
protection switching function is present.
";
augSource-protectedTTPSource NAME BINDING
  SUBORDINATE OBJECT CLASS      "Recommendation G.774": augSource;
  NAMED BY SUPERIOR OBJECT CLASS  protectedTTPSource;
  WITH ATTRIBUTE      "Recommendation G.774": augId;
  BEHAVIOUR augSource-protectedTTPSourceBeh;
REGISTERED AS { g774-03NameBinding 7 };
augSource-protectedTTPSourceBeh BEHAVIOUR
DEFINED AS
"The subordinate managed objects are instantiated when the multiplex-section
protection switching function is present.
";
```

## 12.4 Protection unit

```
protectionUnit-protectionGroupR1 NAME BINDING
  SUBORDINATE OBJECT CLASS
  protectionUnit AND SUBCLASSES;
  NAMED BY SUPERIOR OBJECT CLASS  protectionGroupR1 AND SUBCLASSES;
  WITH ATTRIBUTE protectionUnitId;
REGISTERED AS { g774-03NameBinding 13 };
```

## 12.5 Unprotected connection termination point

```
unprotectedCTPBidirectional-msTTPBidirectional NAME BINDING
  SUBORDINATE OBJECT CLASS unprotectedCTPBidirectional;
  NAMED BY SUPERIOR OBJECT CLASS  "Recommendation G.774": msTTPBidirectional;
  WITH ATTRIBUTE unprotectedCTPId;
  BEHAVIOUR unprotectedCTPBidirectional-msTTPBidirectionalBeh;
REGISTERED AS { g774-03NameBinding 9 };
```

```

unprotectedCTPBidirectional-msTTPBidirectionalBeh BEHAVIOUR
DEFINED AS
"The subordinate managed objects are instantiated when the multiplex section
protection switching function is present.
";
unprotectedCTPSink-msTTPSink NAME BINDING
    SUBORDINATE OBJECT CLASS unprotectedCTPSink;
    NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774": msTTPSink;
    WITH ATTRIBUTE unprotectedCTPId;
    BEHAVIOUR unprotectedCTPSink-msTTPSinkBeh;
REGISTERED AS { g774-03NameBinding 10 };
unprotectedCTPSink-msTTPSinkBeh BEHAVIOUR
DEFINED AS
"The subordinate managed objects are instantiated when the multiplex section
protection switching function is present.
";
unprotectedCTPSource-msTTPSource NAME BINDING
    SUBORDINATE OBJECT CLASS unprotectedCTPSource;
    NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774": msTTPSource;
    WITH ATTRIBUTE unprotectedCTPId;
    BEHAVIOUR unprotectedCTPSource-msTTPSourceBeh;
REGISTERED AS { g774-03NameBinding 11 };
unprotectedCTPSource-msTTPSourceBeh BEHAVIOUR
DEFINED AS
"The subordinate managed objects are instantiated when the multiplex section
protection switching function is present.
";

```

### 13 Subordination rules

None.

### 14 Pointer constraints

None.

### 15 Supporting ASN.1 productions

The following text replaces the entire text within clause 15/G.774.3 (1994). No textual changes (except adding of protectionUnit, which was missing) have been made; the ASN.1 definitions have simply been alphabetically ordered for convenience.

```

SDHProtASN1 {itu-t(0) recommendation(0) g(7) g774(774) hyphen(127) prot(03)
informationModel(0) asn1Module(2) sdhmsp(0)}

```

```

DEFINITIONS IMPLICIT TAGS ::=
BEGIN

```

```

-- EXPORTS everything

```

```

IMPORTS

```

```

NameType

```

```

    FROM

```

```

        ASN1DefinedTypesModule {itu-t(0) recommendation m gnm(3100)

```

```

        informationModel(0)      asn1Modules(2) asn1DefinedTypesModule(0)}

```

```

RelativeDistinguishedName

```

```

    FROM

```

```

        InformationFramework {joint-iso-itu-t ds(5) modules(1)

```

```

        informationFramework(1)}

```

```

ObjectInstance
  FROM
    CMIP-1 {joint-iso-ccitt ms(9) cmip(1) modules(0) protocol(3)}
AdditionalInformation, ManagementExtension
  FROM
    Attribute-ASN1Module {joint-iso-itu-t ms(9) smi(3) part2(2)
      asn1Module(2) 1};

sdhProt OBJECT IDENTIFIER ::= {itu-t(0) recommendation(0) g(7) g774(774)
  hyphen(127)
    prot(03) informationModel(0)}

g774-03MObjectClass OBJECT IDENTIFIER ::= {sdhProt managedObjectClass(3)}

g774-03Attribute OBJECT IDENTIFIER ::= {sdhProt attribute(7)}

g774-03NameBinding OBJECT IDENTIFIER ::= {sdhProt nameBinding(6)}

g774-03Action OBJECT IDENTIFIER ::= {sdhProt action(9)}

g774-03Notification OBJECT IDENTIFIER ::= {sdhProt notification(10)}

g774-03Parameter OBJECT IDENTIFIER ::= {sdhProt parameter(5)}

g774-03Package OBJECT IDENTIFIER ::= {sdhProt package(4)}

-- default value definitions
booleanTrueDefault Boolean ::= TRUE

-- supporting productions
AutoSwitchReason ::= CHOICE {
  waitToRestore      [0] NULL,
  signalDegrade      [1] NULL,
  signalFail         [2] NULL}

Boolean ::= BOOLEAN

FromAndToProtectionUnit ::= CHOICE {
  fromProtectionUnitNumber [0] RelativeDistinguishedName ,
  toProtectionUnitNumber  [1] RelativeDistinguishedName }

--The fromProtectionUnitNumber is used for protecting protection unit in order to
--hold the name of the protected protection unit which has been protected by that
--protecting protection unit. The toProtectionUnitNumber is used for protected
--protection unit in order to hold the number of the protecting protection unit
--to which it has been switched to. In case of a MSP 1+1 system these parameters
--are not mandatory.--

Integer ::= INTEGER

InvokeExerciseArg ::= SEQUENCE {
  protectionEntity ProtectionEntity OPTIONAL, -- if absent, all PUs
  otherInfo        SET OF ManagementExtension OPTIONAL}

InvokeExerciseReply ::= SET OF SEQUENCE {
  protectionUnit RelativeDistinguishedName,
  result         LastAttemptResult}

InvokeProtectionArg ::= SEQUENCE {
  switchType SwitchType,
  protectionEntity ProtectionEntity OPTIONAL, -- if absent, all PUs
  otherInfo        SET OF ManagementExtension OPTIONAL}

```

```

InvokeProtectionError ::= ENUMERATED {
    preempted      (0),
    failure        (1),
    timeout        (2)}

LastAttemptResult ::= CHOICE {
    success        [0] NULL, -- default value
    denied         [1] NULL,
    fail           [2] RxTxAPS}

ProtectionDirection ::= ENUMERATED {
    transmit       (0),
    receive        (1),
    bidirectional  (2) }

ProtectionEntity ::= SEQUENCE {
    protectedUnits [0] SEQUENCE OF RelativeDistinguishedName OPTIONAL,
    protectingUnits [1] SEQUENCE OF RelativeDistinguishedName OPTIONAL
}
--In case of a 1+1 non-revertive MSP system for a manual switch from the
--protecting protection unit to the protected one, the protectingUnits field
--shall be used and shall indicate the protection unit which has the channel
--number 0. If both fields are present they should be compatible sequences--

ProtectionGroupType ::= ENUMERATED {
    plus          (0), -- 1+1 (1 plus 1) or hot-standby
    colon         (1) -- M:N (M for N)
}

ProtectionMismatchStatus ::= SEQUENCE {
    uniBi         [0] BOOLEAN,
    plusColon     [1] BOOLEAN}

ProtectionStatus ::= SET OF CHOICE {
    noRequest     [0] NULL,
    doNotRevert  [1] NULL,
    manualSwitch [2] SEQUENCE {
        requestSource [0] RequestSource OPTIONAL,
        switchStatus  [1] SwitchStatus,
        relatedChannel [2] FromAndToProtectionUnit},
    autoSwitch    [3] SEQUENCE {
        requestSource [0] RequestSource OPTIONAL,
        switchStatus  [1] SwitchStatus,
        relatedChannel [2] FromAndToProtectionUnit,
        autoSwitchReason [3] AutoSwitchReason},
    forcedSwitch  [4] SEQUENCE {
        requestSource [0] RequestSource OPTIONAL,
        switchStatus  [1] SwitchStatus,
        relatedChannel [2] FromAndToProtectionUnit},
    lockout       [5] SEQUENCE {
        requestSource [0] RequestSource OPTIONAL,
        switchStatus  [1] SwitchStatus},
    releaseFailed [6] NULL,
    protectionFailCondApsInvalid [7] BOOLEAN,
    protectionFailCondChannelMismatch [8] BOOLEAN }

ProtectionStatusParameter ::= SEQUENCE {
    oldProtectionStatus ProtectionStatus,
    newProtectionStatus ProtectionStatus,
    psDirection         ProtectionDirection DEFAULT bidirectional}

```

```

ProtectionSwitchMode ::= ENUMERATED {
    bidirectional      (0),
    unidirectional    (1)}

ProtectionSwitchReportingInfo ::= SEQUENCE {
    protectingUnit      RelativeDistinguishedName,
    additionalInfo      AdditionalInformation}

ProtectionUnit ::= CHOICE {
    protectingUnit      [0] RelativeDistinguishedName,
    protectedUnit      [1] RelativeDistinguishedName }

ReleaseProtectionArg ::= SEQUENCE {
    switchType          SwitchType,
    protectionEntity    ProtectionEntity,
    otherInfo           SET OF ManagementExtension OPTIONAL}

ReleaseProtectionError ::= ENUMERATED {
    failure             (0),
    timeout             (1)}

RequestSource ::= ENUMERATED {
    local               (0),
    remote              (1) }

ResourcePointer ::= CHOICE {
    null                NULL,
    objectInstances     SEQUENCE OF ObjectInstance }

RxTxAPS ::= SEQUENCE {
    rxAPSvalue          [0] INTEGER,
    txAPSvalue          [1] INTEGER} -- APS byte 1 in low order byte , byte 2
                                   -- in high order byte

SDHMSPriority ::= Integer(1 .. 2)
    -- 1 = high priority, 2 = low priority

SDHMSResourcePointer ::= ResourcePointer(WITH COMPONENTS {
    ...,
    objectInstances(SIZE(1))
} )

SwitchStatus ::= ENUMERATED {
    pending             (0),
    completed           (1),
    operateFailed       (2)}

SwitchType ::= ENUMERATED {
    manual              (0),
    forced              (1),
    lockout             (2)}

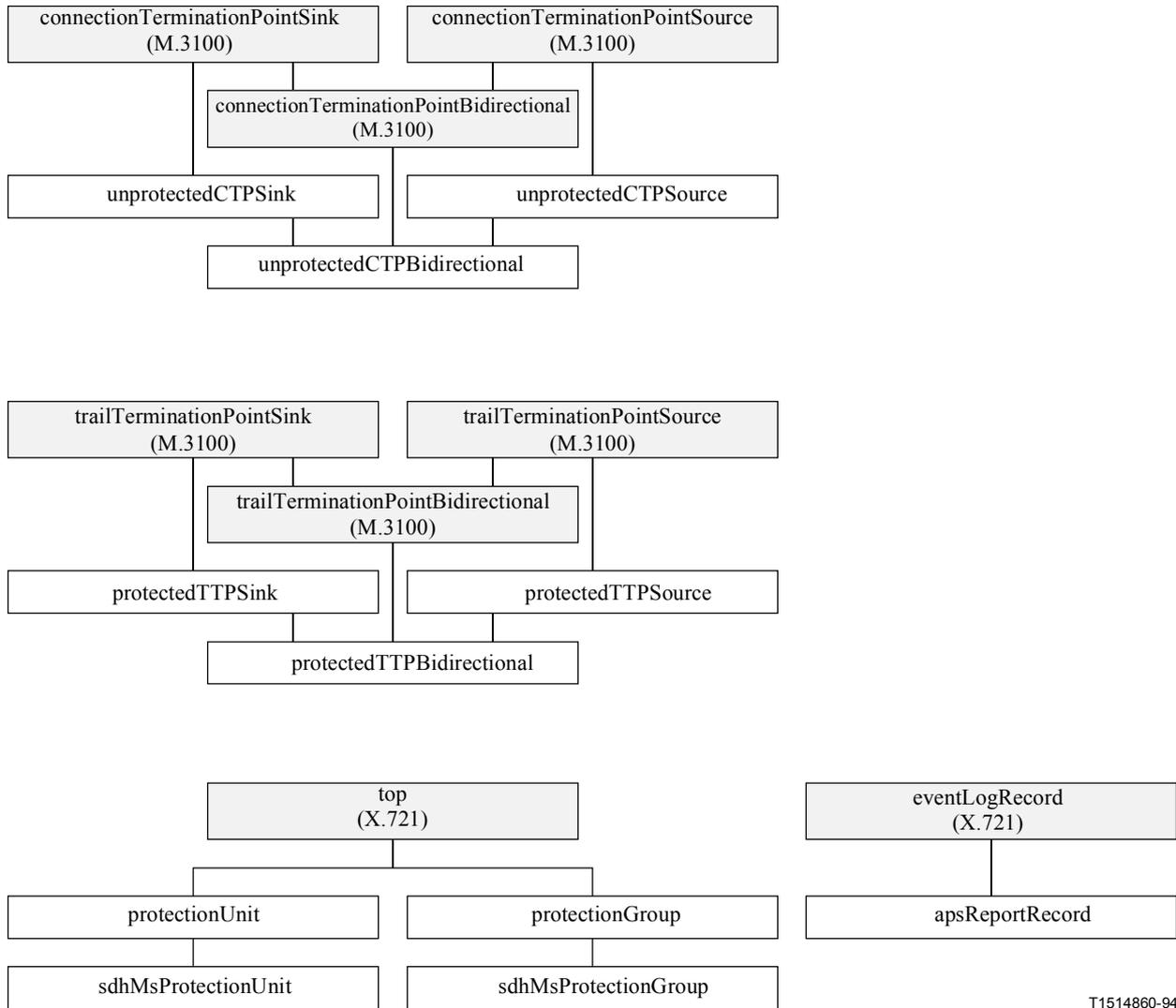
END

```

APPENDIX I

**Naming and Inheritance Diagrams**

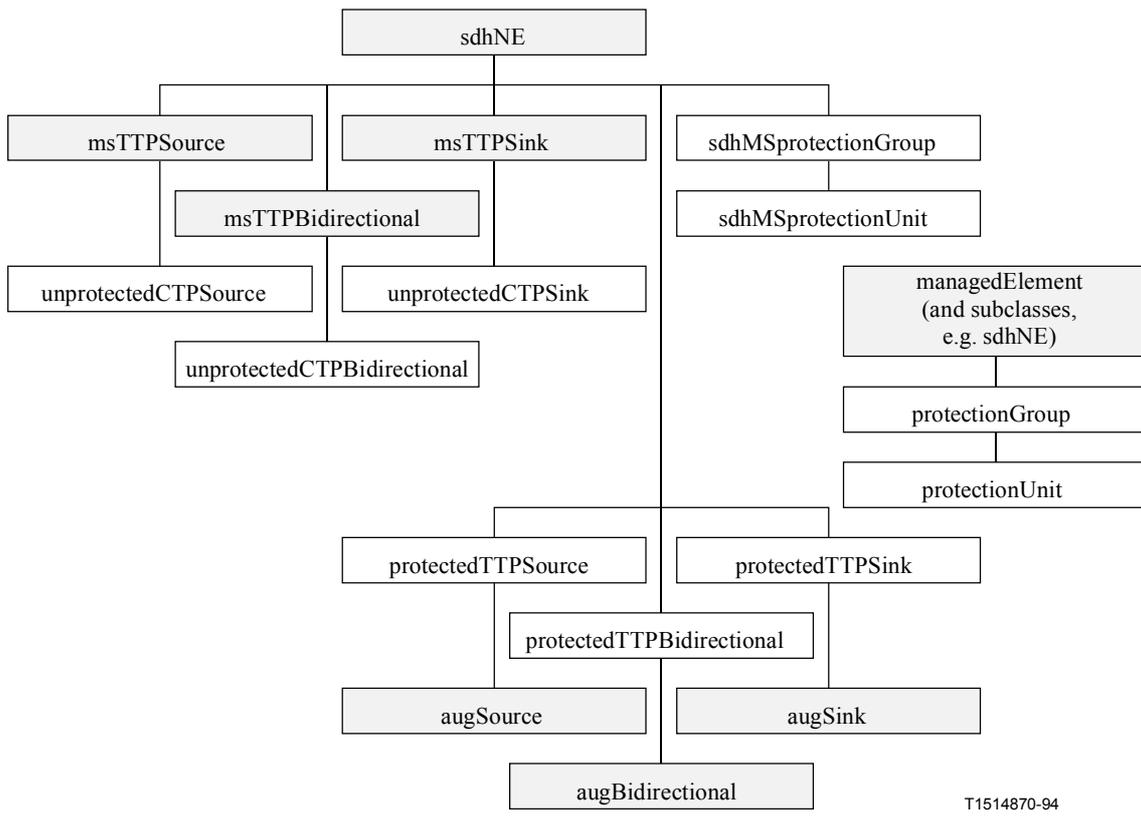
See Figures I.1 and I.2.



T1514860-94

Not defined in this Recommendation.

**Figure I.1/G.774.3 – SDH MS Protection Inheritance Diagram**



T1514870-94

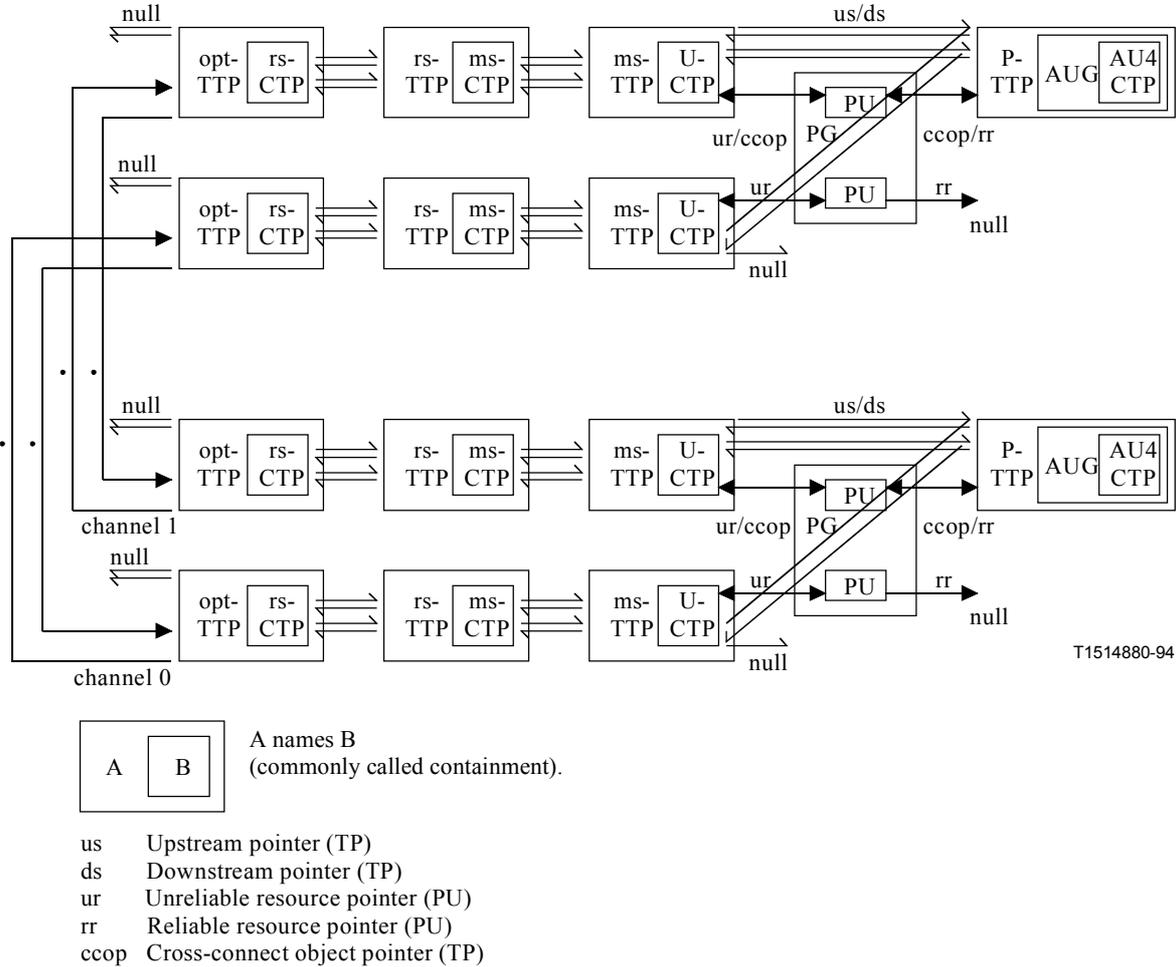
Not defined in this Recommendation.

**Figure I.2/G.774.3 – SDH MS Protection Naming Diagram**

APPENDIX II

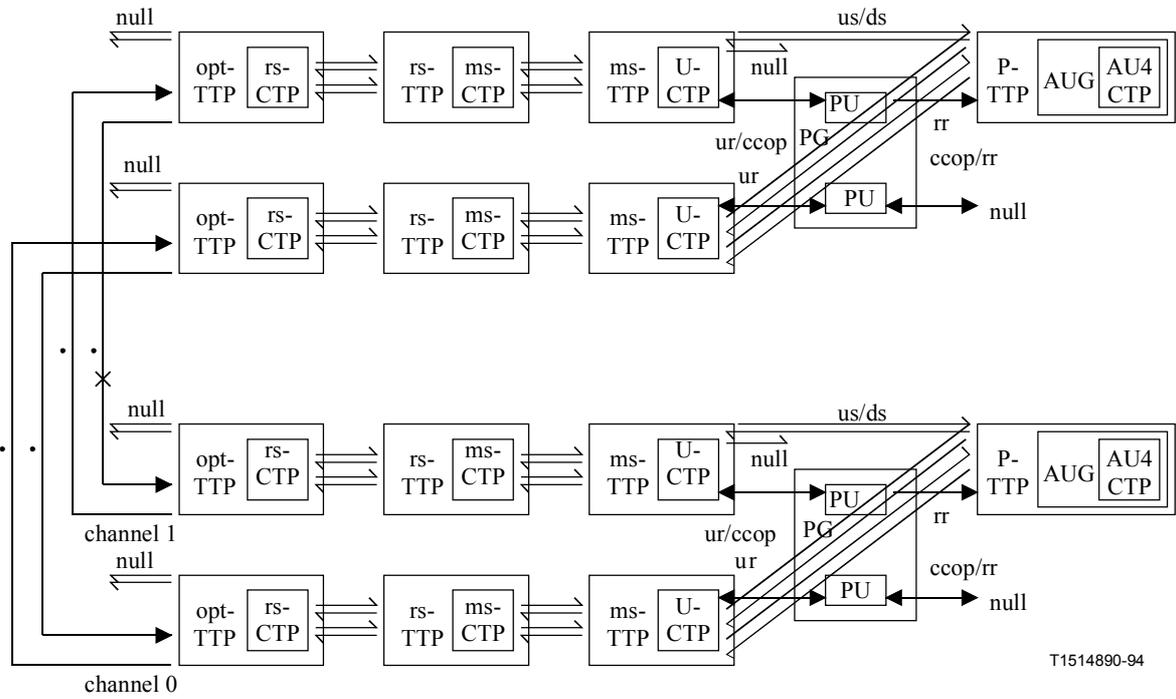
Examples of MS Protection

See Figures II.1 to II.6.

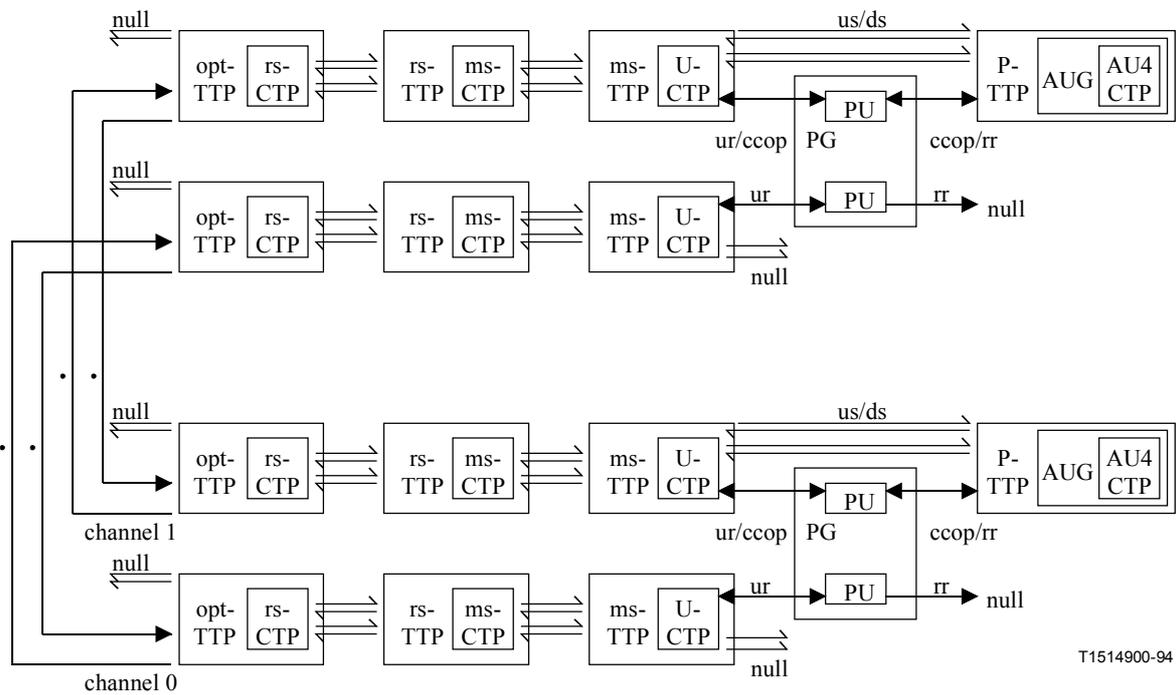


T1514880-94

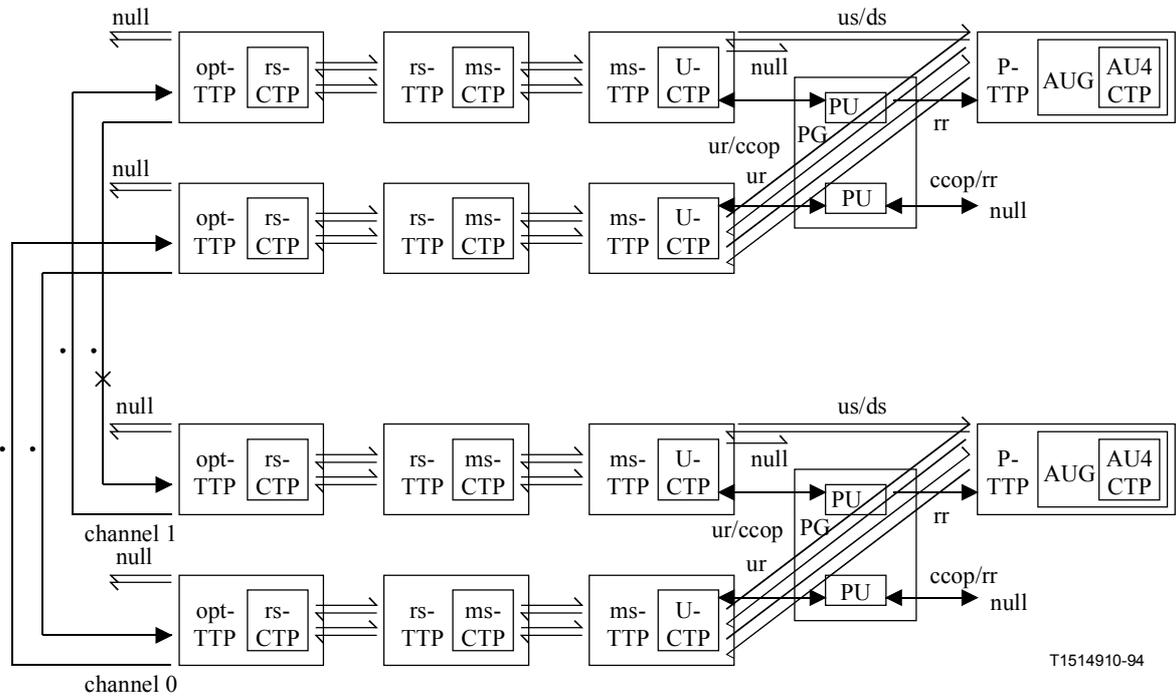
Figure II.1/G.774.3 – Example of 1 + 1 Linear MS protection, normal case, traffic on channel 1



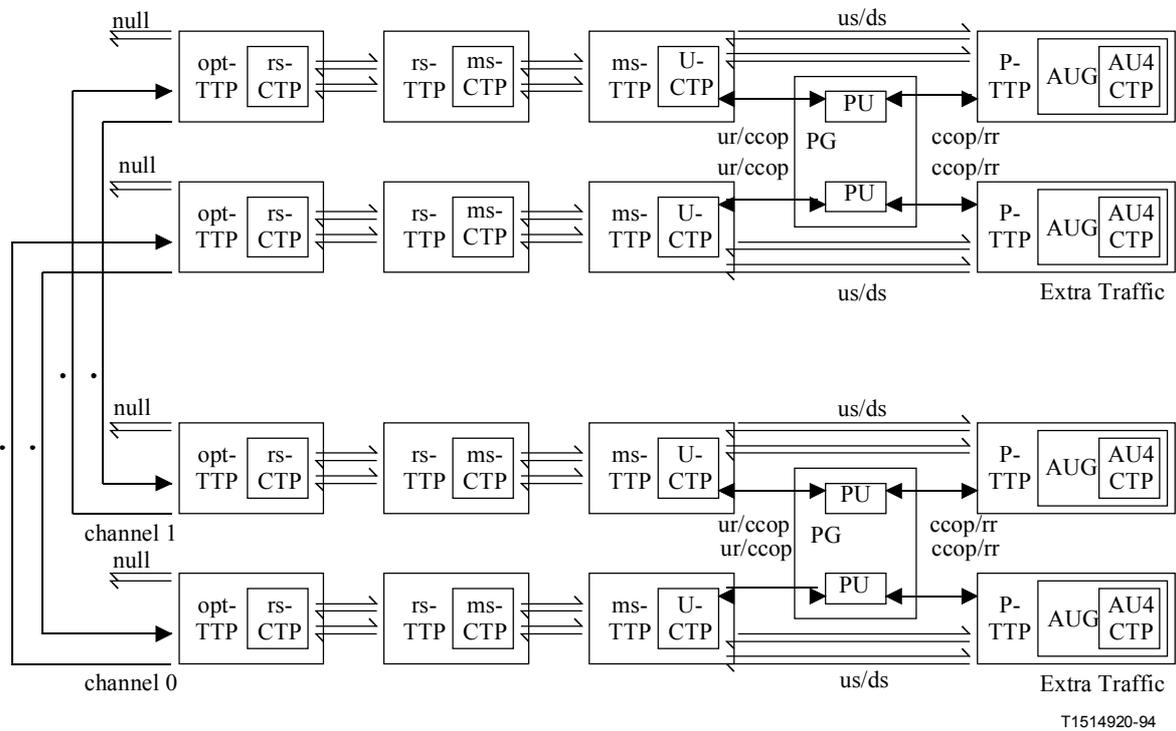
**Figure II.2/G.774.3 – Example of 1 + 1 Linear MS protection, failure of channel 1, traffic switched onto channel 0**



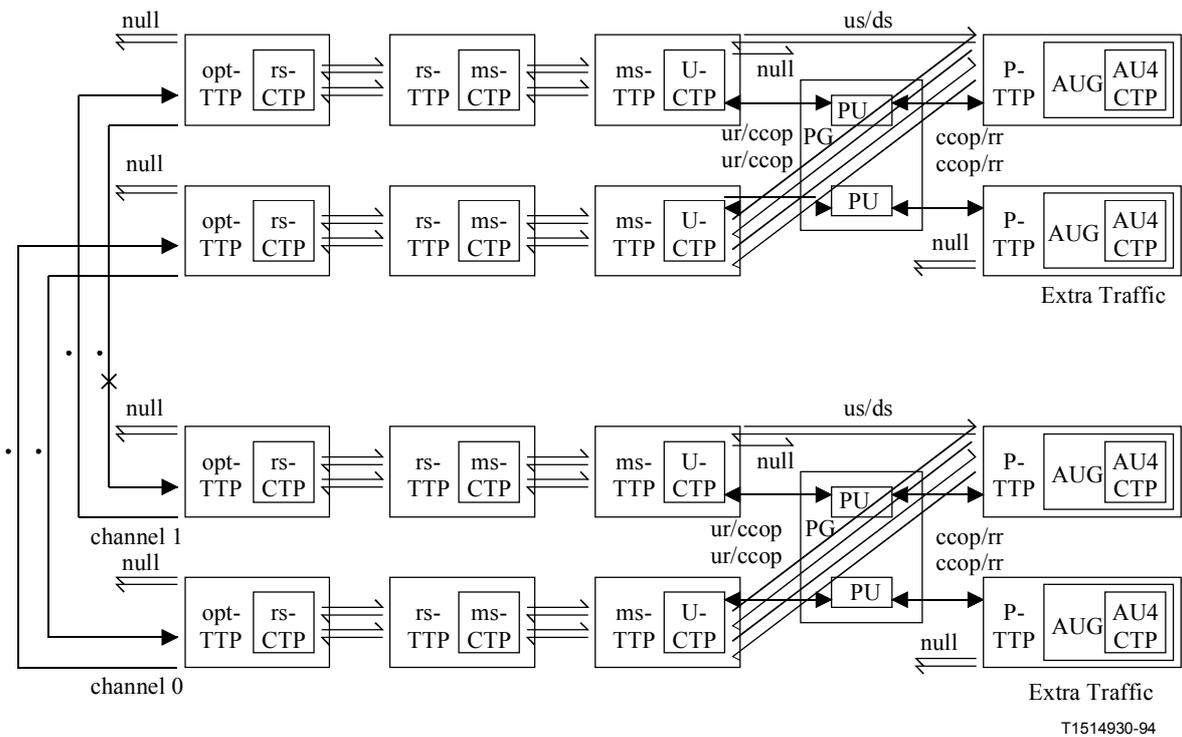
**Figure II.3/G.774.3 – Example of 1:1 Linear MS protection, normal case, no extra traffic**



**Figure II.4/G.774.3 – Example of 1:1 Linear MS protection, failure of working channel (channel 1), traffic switched onto protecting channel**



**Figure II.5/G.774.3 – Example of 1:1 Linear MS protection with extra traffic, normal case**



**Figure II.6/G.774.3 – Example of 1:1 Linear MS protection with extra traffic, failure of working channel (channel 1), traffic switched onto protecting channel**





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