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MAINTENANCE: INTRODUCTION AND GENERAL PRINCIPLES

PRINCIPLES FOR USING ALARM INFORMATION FOR MAINTENANCE OF INTERNATIONAL TRANSMISSION SYSTEMS AND EQUIPMENT

ITU-T Recommendation M.32

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation M.32 was published in Fascicle IV.1 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation M.32

PRINCIPLES FOR USING ALARM INFORMATION FOR MAINTENANCE OF INTERNATIONAL TRANSMISSION SYSTEMS AND EQUIPMENT

1 General

1.1 This Recommendation presents the general principles for employing those maintenance features and capabilities of international transmission systems and equipment which are based on alarm information.

It describes a set of strategies, in addition to the maintenance philosophy in Recommendation M.20, to use these alarm-based features and capabilities in an effective and efficient manner. This Recommendation is also intended to address the interactions between alarms of digital and analogue transmission systems and equipments.

Alarm interactions for mixed analogue/digital transmission systems and equipment are under study.

1.2 While this Recommendation discusses the strategy to employ these features and capabilities, the actual arrangements to provide and use them are left to the discretion of the Administrations.

2 Types of alarms and related messages

Alarm information may be categorized as follows:

a) Prompt maintenance alarm (PMA);

b) Deferred maintenance alarm (DMA);

c) Maintenance event information (MEI).

Definitions of PMA, DMA and MEI are found in Recommendation M.20, § 5.4.1.

3 Guidance for using alarm information

3.1 *Hierarchy*

The alarm information from transmission systems and equipment is based on a hierarchy of:

a) alarms and indications displayed on failed equipment or systems,

b) office audible/visual alarms which alert local staff, and

c) remote information which appears on a display monitored by centralized maintenance staff which is not collocated with the failed equipment or systems.

This alarm hierarchy is used in failure localization, either for a maintenance entity, or for specific equipment within a maintenance entity.

3.2 *Display*

Alarm information can be displayed to help in localization in different ways, such as:

a) locally – on the equipment,

b) on site – in the same building as the equipment, or

c) remotely – at a building not collocated with the equipment.

Both localized and on-site displays are used by on-site maintenance staff. Remote displays are normally used either for coverage during periods when a building is not staffed or to obtain a wider maintenance perspective from a single location on a possibly large number of systems.

For example, the remote maintenance strategy of § 3.5 can be used first to localize a trouble to a maintenance entity. Then, maintenance staff can obtain further remote (or otherwise made available) information to localize the failure to specific equipment. After this, the maintenance staff can use the local alarm maintenance strategy of § 3.7 to isolate and correct the failure.

3.3 *Considerations for local or remote alarm monitoring*

Alarm information may be displayed locally on equipment, or on-site in the same building as the monitored equipment using external monitoring equipment. Use of such displays implies that maintenance staff must be present or visit the site to observe the information.

Remote alarm monitoring provides a means for staff at a centralized location, not collocated with the transmission systems and equipment, to monitor them.

The choice between local and remote monitoring and the degree of centralization and automation employed depends on a number of factors, including the type of maintenance organization, the expected failure rates and the physical locations involved.

3.4 *Reducing unnecessary maintenance activity*

When an equipment failure requiring some maintenance activity occurs, alarms should, if possible, be generated by the maintenance entity of which the equipment is part. The general rule is that maintenance activities should be directed only at the maintenance entity in which the failure exists. Thus, techniques should be used which prevent unwanted alarms (and the resulting unnecessary maintenance activity) beyond the maintenance entity in which a failure exists. Also, maintenance entities downstream of the failed maintenance entity should have a means of recognizing that a failure has occurred upstream, as part of the aim of reducing maintenance activity. Provision may be made at a maintenance entity to indicate an upstream failure and/or inhibit unnecessary actions. For example, in digital transmission systems and equipment, this may be accomplished by the use of:

- alarm indication signal (AIS);
- service alarm (SA);
- upstream failure indication (UFI).

For definition of AIS, SA and UFI see Recommendation M.20, § 5.4.2.

3.5 *Considerations for remote maintenance alarm information*

Remote maintenance alarm information provides a means for staff not collocated with transmission systems and equipment to nonetheless monitor and control them. The monitored equipment may be located in unstaffed locations. This section recommends the principles which should be followed if remote alarm information is provided.

3.5.1 Identification and localization are required to determine what the response should be: start restoration of service by using alternate routes, dispatch for maintenance of failed equipment, or wait and gather further information to better identify the nature and/or seriousness of the problem.

3.5.2 The decision to send maintenance staff is based upon the maintenance philosophy in Recommendation M.20, § 1.1.

3.6 *Maintenance alarm arrangements*

Maintenance alarm arrangements are based on the use of audible/visual alarm systems. These systems provide alarms which direct on-site staff to the location of the failed equipment. The objective when providing audible/visual alarm indications is that they should permit on-site maintenance staff to detect and locate the source of failure in a timely fashion in line with other priorities. Note that distinctive sounds may be used to differentiate audible alarms. Also, visual signals should be able to direct maintenance staff to the failed equipment or to a point where the location of the failure can be determined.

3.7 *Use of local alarm information*

3.7.1 Local alarm information is concerned with alerting on-site maintenance staff to equipment failures. The local maintenance activities usually entail the location and correction of the failure. To carry this out effectively and efficiently, information which helps direct the maintenance staff to the failure should be provided directly from the failed equipment.

3.7.2 Local alarm information is derived from local failure indications, together with the maintenance staff use of tests and relevant documentation. This should be sufficient to localize the failure within the failed equipment.

3.7.3 Note that a further purpose of local failure indications is to provide a backup for remote indications, in the event that there is a failure in communications between monitored equipment and a central monitoring location.

4 General considerations

4.1 *Monitoring*

In general, failures of equipment should be detected by continuous (or nearly continuous) automatic monitoring, as opposed to monitoring or testing involving human intervention. Note that shared, but automatic, monitoring is considered nearly continuous. Continuous (or nearly continuous) monitoring is often made feasible by virtue of advances in technology, and by virtue of the large number of circuits affected or jeopardized by a transmission system failure. In addition, continuous (or nearly continuous) monitoring is faster, more reliable, and less labor intensive than alternative monitoring strategies.

4.2 *Uses of PMA, DMA and MEI*

4.2.1 When reporting or displaying alarms either locally or remotely, it is important to distinguish between PMA/DMA indications and MEI indications. PMA/DMA indications are those which cause maintenance staff to be alerted (e.g., by ringing a bell), and MEI indications are those which are displayed in response to staff interrogations or in conjunction with other indications (e.g., alarms) which are spontaneously generated.

4.2.2 These distinctions should be defined for each transmission system and equipment in order for alarm indications to be properly processed. These distinctions may be of particular importance when using remote alarm surveillance systems, where large numbers of PMA, DMA and MEI indications must be dealt with by maintenance staff.

4.2.3 MEI indications may be used as aids in failure localization or verification of remote operations (such as remote control of protection switching) under manual control. The information conveyed by MEI indications may also be used to supplement that convoyed by PMA/DMA indications.

4.2.4 Note that detection of failures is accomplished by having suitable monitors associated with each maintenance entity. The criteria for activating alarm indications at a maintenance entity should generally be based on limits on the maintenance entities, which will generally be related to the performance objectives of the transmission systems.

4.2.5 To aid in the dispatch of personnel, remote indications should include the following information:

a) identification of the failed transmission system or equipment and nature of trouble condition,

b) distinction between service-affecting failures and non- service-affecting failures where such a distinction is possible, and

c) severity of the failure which has occurred.

4.3 *Transmission and presentation of alarm information*

4.3.1 There are two basic interface arrangements for transferring alarm information between monitored and monitoring equipment:

a) discrete, parallel, and

b) serial data.

The parallel method of data gathering and control uses discrete wires for implementing each function. The serial data method of gathering and control uses a single pair of wires to carry serial (in time) data points, rather than individual wires for each point. Much new telecommunications equipment is “intelligent”, that is, it employs microprocessor circuit design, which lends itself more readily to serial data transfer rather than to parallel.

4.3.2 The presentation of alarm information can be:

a) visual (lamp, LED, printer or display indication), and/or

b) audible (bell, tones or voice).

The alarm information may be presented as:

a) an indication at an alarm interface (e.g., contact function, d.c. signal) and/or

b) an alarm message on the man-machine interface.

This alarm message may contain:

i) heading (name of maintenance entity, date, time, etc.),

ii) category of failure (PMA, DMA, MEI),

iii) description of failure, which may include the cause of failure, location of the failed item(s) and other information which can be useful in locating the failed item(s),

iv) possible consequences of the failure, and

v) automatic actions performed by the network (internal protection and service actions).

4.4 *Possible use of MEIs*

Administrations using MEI may desire to alert maintenance staff by means of a PMA or DMA. The criteria and arrangements[1)] for generating PMA or DMA based on analysis of MEI are left to their discretion.

4.5 *Considerations for protection switching and control*

To meet transmission system availability objectives or maintenance criteria, transmission systems may be provided with protection equipment. Such equipment, if provided, may have the following capabilities:

a) automatic protection switching of service from failed regular equipment to working standby equipment,

b) automatic protection switching of service to overcome transmission degradation caused, for example, by radio path fading,

c) remotely controlled protection switching of service between regular equipment and standby equipment, and/or

d) locally controlled protection switching of service between regular equipment and standby equipment.

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1) The arrangements to generate such information may take place in the transmission system or in auxiliary supervision systems.