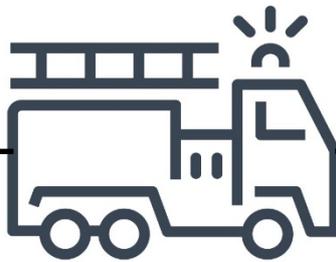


**Guidance
Note**



Fire Industry Association

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**Guidance on fire alarm routing connections to an
ARC and relevant standards**

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1. INTRODUCTION

This FIA guidance document is intended to support end users, installers, and other interested groups in understanding the standards associated with signalling to an alarm receiving centre (ARC) and the differences between fire and security applications. This document covers the broad recommendations contained within EN 54-21 and the use of dual path signalling.

2. BACKGROUND

The performance characteristics for any alarm transmission system used for signalling from a protected premises are defined by BS EN 50136-1, which was originally published in 1998 and defines the measures by which the transmission system can be characterised. Whilst BS EN 50136-1 has changed considerably, with a complete revision in 2012 and an update in 2018, it is referenced in EN 54-21 and the 1998 content remains current.

Separate standards exist for fire and security alarm transmission applications where specific recommendations on the BS EN 50136-1 performance characteristics which should be used are given.

For security applications, until recently a grading system was used to characterise the performance and other requirements necessary defined in BS EN 50131-1. For fire alarm systems the alarm transmission system performance is given by BS EN 54-21 and the application recommendations are defined in BS 5839-1:2017.

The use of dual path alarm transmission systems has become increasingly popular over the last 15 years where alternative signal paths are provided over different network providers and/or technology to increase the overall system reliability. Security system installation standards define specific system grades which call up specific alarm transmission performance; for some grades more than one alarm transmission system is recommended, but where this occurs the secondary path reliability might not be as high as the primary path.

For fire alarm systems, a dual path signalling system is generally required to meet the performance requirements of EN 54-21, or to satisfy some risk assessment need. This could include a system where a site is unmanned for significant periods and intervention to resolve a signal path fault may be delayed.

3. BS EN 50136-1 ALARM TRANSMISSION SYSTEM METRICS

BS EN 50136-1 Alarm transmission systems and equipment defines metrics which are used by application specific standards to define the required performance of the alarm transmission systems. BS EN 54-21 refers to the version published in 1998 and the characteristics of significance are summarized here; however, it is important to realise that the subsequent publications of this standard have updated these metrics.

3.1 System performance characteristics

- **Transmission time**

This is the signal time across the Alarm Transmission System (ATS) and is measured in seconds. For fire alarm systems, the speed of transmission is not necessarily the most important factor, however ensuring the signal is received is given a greater emphasis. EN 54-21 requires D4 and M4 compliance.

Transmission Time Classification Class	Transmission time (s)				
	D0	D1	D2	D3	D4
Arithmetic mean of all transmissions	-	120	60	20	10
95% of all transmissions	240	240	80	30	15

Transmission Time Maximum Values Class	Maximum time (s)				
	M0	M1	M2	M3	M4
Maximum period	-	480	120	60	20

- **Reporting time classifications**

Reporting time is the maximum period between a fault occurring in the alarm transmission system and the fault information being reported to the alarm receiving centre. A low reporting time is desirable for fire alarm transmission systems. EN 54-21 requires a reporting time of 90 seconds or less.

Reporting Time Class	Reporting time (s)					
	T1 (days)	T2 (h)	T3 (Min)	T4 (s)	T5 (s)	T6 (s)
Maximum period	32	25	300	180	90	20

- **Availability**

This is a measure of the reliability of the system that is measured across an estate of alarm transmission systems provided by the service provider and measured as a percentage. A high degree of availability is required for fire alarm transmission systems. EN 54-21 requires an availability class A4 or 98%. This is possible with a dual path system where each path has an availability of 96%.

Availability Class	Availability %				
	A0	A1	A2	A3	A4
Availability of overall system in any 12 month period	-	97	99.3	99.5	99.8
Monthly availability	-	75	91	95	98.5

- **Substitution security and information security**

These are measures against unauthorised substitution of data at the premises and interception or gathering of data from the alarm transmission system. These measures are particularly important for security systems but less important for fire alarm transmission systems.

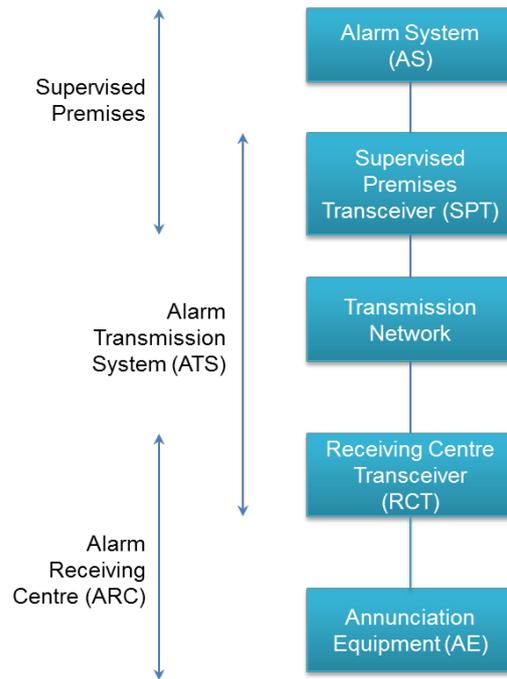
4. **BS EN 54-21, FIRE DETECTION AND ALARM - TRANSMISSION AND FAULT WARNING EQUIPMENT**

BS EN 54-21 was published in 2006 and became mandatory as a harmonized standard under the CPR on the 1st of January 2014. This standard draws on the recommendations contained in the 1998 published version BS EN 50136-1-1 and BS EN 50136-1-2 but has not since been amended.

The standard moves away from using terms such as “signalling” and describes various aspects of the system referring to standard definitions detailed within BS EN 50136-1. In EN 54-21 the phrase “routing equipment” is used extensively.

4.1 Summary of 50136 terminology

EN 50136 - Terminology	
ADSL	Asymmetric Digital Subscriber Line
AE	Annunciation Equipment
ARC	Alarm Receiving Centre
AS	Alarm System
ATE	Alarm Transmission Equipment
ATP	Alarm Transmission Path
ATS	Alarm Transmission System
ATSN	Alarm Transmission Service Network
ATSP	Alarm Transmission Service Provider
DSL	Digital Subscriber Line
DTMF	Dual Tone Multi Frequency
GSM	Global System Mobile
ISO	International Standardisation Organisation
ISDN	Integrated Service Digital Network
MCT	Monitoring Centre Transceiver
OSI	Open Systems Interconnection
PSN	Packet Switched Network
PSTN	Public Switched Telephone Network
RCT	Receiving Centre Transceiver
SPT	Supervised Premises Transceiver
SDSL	Symmetric Digital Subscriber Line



BS EN 54-21 alarm transmission routing equipment at the supervised premises has the following functional requirements, which includes the capability to receive and display a signal generated by the alarm receiving centre and sent in response to an alarm signal from the site.

Acknowledgement signal:

- A signal generated by the ARC must be sent to the routing equipment following receipt of an alarm by the ARC. This is an alarm transmission assurance signal in terms of BS EN 50136-1-1.

4.2 Equipment capabilities

Alarm transmission routing equipment capabilities:

- Receive a fire alarm signal from the CIE.
- Receive a fault warning signals from the transmission network.
- Receive acknowledgement signal from the alarm receiving centre.
- Transmit a fault warning signals to the CIE.
- Transmit a fire alarm signal to the fire alarm receiving centre.
- Transmit an acknowledgement to the CIE.

Fault warning routing equipment capabilities:

- Receiving fault warning signal from the CIE.
- Receiving fault warning signals from the transmission network.
- Transmitting fault warning signals to the CIE.
- Transmitting fault warning signals to the fault warning receiving centre.

4.3 Local indication of signals

BS EN 54-21 requires that the following local indications need to be available at the protected premises, however these may be integrated with the fire alarm control and indicating equipment. Control panels that have a BS EN 54-21 declaration of performance are expected to include these indications, otherwise alternative means to display these may be required.

- An acknowledgement signal from fire alarm receiving centre (RED).
- At least a common fault should be given for the following (Yellow):
 - A non-receipt of an acknowledgement signal;
 - A fault warning indicating a failure within the routing equipment;
 - A fault warning indicating a failure within the alarm transmission network;
 - An open or short circuit fault in remote connections to the control and indicating equipment.

4.4 Alarm transmission system performance

BS EN 54-21 defines two appropriate performance grades made up of the individual characteristics detailed in BS EN 50136-1:1998.

Type of transmission system	Primary transmission path	Redundancy / duplication	Transmission time classification D ^{c)}	Transmission time, maximum values M ^{c)}	Reporting time classification T ^{c)}	Availability Classification A ^{a)}	Substitution Security S	Information security I
Type 1 ^{b)}	Dedicated alarm paths	In accordance with EN 50136-1-1:1998, 6.4.1	D4 = 10 s	M4 = 20 s	T5 = 90 s ^{d)}	A4 ^{a)}	S0	I0
Type 2 ^{b) e)}	Digital communicator systems using the public switched telephone network	In accordance with EN 50136-1-1:1998, 6.4.1	D4 = 10 s	M3 = 60 s	T2 = 25 h (complete path) T5 = 90 s (network access)	A4 ^{a)}	S0	I0

^{a)} This is the overall availability that includes all signalling paths.
^{b)} To achieve the availability requirements of this standard redundancy/duplication in accordance with EN 50136-1-1:1998, 6.4.1 may be used.
^{c)} Each of the parameters – D, M and T – shall be fulfilled by at least one of the transmission paths of the chosen type (Type 1 or Type 2).
^{d)} The reporting time classification T3 may be applied when using radio systems.
^{e)} When using analogue public switched networks (PSTN) D2 and M2 may be applied.

5. SIGNAL PATHS AND TECHNOLOGY CONSIDERATIONS

Dual or single path alarm transmission system performance will be significantly dependent upon the technology in use, the transmission path media and service provision available.

It is recognised in BS EN 54-21 that to achieve the required performance for system availability it may be necessary to utilise duplication where dual path alarm transmission systems are used.

It should be noted that for some applications the available transmission paths are limited and may not allow a dual path solution. For example, the limited life of the PSTN network and the availability of a reliable dual path GPRS signal at specific locations may necessitate reliance on a single path Internet Protocol (IP) connection or other single path solution.

IP connections also have potential issues:

- a) Adequacy of the local IT infrastructure including the power supplies, connections, and access to change, reconfigure or reset infrastructure including routers, switches, fire walls, hubs, patch panels etc.
- b) A lack of EN 54-4 standby power supplies means that power supply performance is unknown which could result in loss of connection in a local power outage.
- c) Performance and availability of the local IP connectivity is usually under the control of third parties; the fire alarm provider is typically not consulted nor has the relevant contact details.

Some issues encountered:

- a) Changes to firewalls or port configuration.
- b) Upgrades (hardware or firmware).
- c) Risk of unauthorised disconnection of Ethernet RJ45 connectors even if they are properly labelled.
- d) Use of domestic grade switches, modems etc that do not have built-in resilience.
- e) Default passwords such as 'admin/admin' putting the network at risk.
- f) Lack of notification when LAN components are not working.

Some dual path scenarios are ineffective where the technology in use at the protected premises is not adequately considered, for example where an existing telephone line connection is routed through a voice over IP connection and combined with a local area IP network connection, a single failure in the local IT infrastructure would result in total failure of both transmission paths giving no benefit over a single path alarm transmission system.

In some applications a single path GPRS (Radio) or IP solution may be the only transmission path option available.

When considering an alarm transmission system where a non BS EN 54-21 compliant solution is proposed, the performance of the system in terms of its reporting time and system availability should be considered in the risk assessment.

It is likely that such a solution would require a variation to BS 5839-1.

6. ALARM TRANSMISSION SYSTEMS (ATS) CATEGORIES AND PD 6669

All alarm transmissions systems use the performance characteristics as defined by BS EN 50136-1. In the latest versions of this standard, performance characteristics required are categorised in terms of single and dual path alarm solutions, “SP1 to SP6” for single path and “DP1 to DP4 for dual path solutions”.

Further guidance for the provision of alarm transmission systems (ATS) for alarm systems in the UK is given in PD 6669:2017, which introduces additional performance categories SP3+ and DP2+.

PD 6669 makes other recommendations and introduces new concepts such as the operation of a dual path alarm alternative path when the primary path has failed in a transmission system. It also sets out new definitions such as catastrophic failure and additional recommendations on reporting and availability.

The table below (Appendix B from PD 6669) highlights all the ATS categories and the associated parameters.

Maximum reporting time based on BS EN 50136-1 - showing additional DP and SP categories:

	SP1	SP2	SP3	SP3+	SP4	SP5	SP6	DP1	DP2	DP2+	DP3	DP4
Primary ATP reporting time	32 days	25 h	30 m	10 m	3 m	90 s	20 s	25 h	30 m	10 m	3 m	90 s
Alternative ATP maximum period when primary operational	Op	Op	Op	Op	Op	Op	Op	50 h	25 h	25 h	25 h	5 h
Alternative ATP maximum period when primary failed	Op	Op	Op	Op	Op	Op	Op	25 h	30 m	10 m	3 m	90 s
Catastrophic failure	32 days	25 h	30 m	10 m	3 m	90 s	20 s	25 h	31 m	11 m	4 m	3 m
ATS reporting time ^{A)}	32 days	25 h	30 m	10 m	3 m	90 s	20 s	50 h	60 m	20 m	6 m	3 m

^{A)} Where an ATS includes more than two ATPs, the ATS reporting time should meet the requirements of this table.

NOTE Op = Optional.

7. BS 5839 PART 1 COMMUNICATION WITH THE FIRE & RESCUE SERVICE

BS 5839 Part 1 recommends that alarm transmission and fault routing equipment should conform to the product requirements of BS EN 54-21, but excludes the installation requirements, it is included as a normative reference.

Within the commentary of section 15 which deals with communication with the fire and rescue service it is highlighted that...

“The reliability of the means for summoning the fire and rescue service, whether by manual or automatic means, always needs to be subject to consideration. Various methods of automatic alarm transmission system to an ARC are available. Their performance, reliability and security characteristics vary, depending upon the type of technology used. BS EN 50136-1 defines ten categories of alarm transmission system (ATS): SP1 to SP6 are based on a single alarm transmission path. DP1 to DP4 add resilience by requiring a dual transmission path.

Alarm transmission systems that incorporate reporting of an alarm transmission path (ATP) failure are preferred. The reporting time period varies with the ATS category selected (32 days to 90 seconds). BS EN 50136-1 shows these performance criteria together with alarm transmission times and the ATS and ATP availability in any 7-day period.”

This identifies that the consultation which defines the needs for the fire detection and fire alarm system should also include the performance criteria of the alarm transmission system required.

Note that reporting time is a critical performance criterion, for example a SP2 categorised alarm transmission system has a reporting time of 25 hours, which means that it may not be known for up to 25 hours that the alarm transmission system is in fault.

While BS 5839-1 does not specifically recommend a minimum performance level, the BS EN 54-21 compliant recommendation suggests a dual path solution is not untypical within the limits of what’s possible.

15.2 Dual path alarm transmission

The clauses below are from BS 5839 Part 1 and make it clear that IP connected systems that utilise a local IT infrastructure are potentially vulnerable to disconnection or loss of power and highlights that such services in a single path alarm transmission system will need additional consideration. A dual path solution may be more appropriate.

“p) Faults in either the alarm transmission equipment or in the alarm transmission path should be displayed at the CIE.

NOTE 11 It is recognized that temporary loss of service in the alarm transmission path or service provision might occur. The risk associated with loss of communications can be mitigated by use of a dual path alarm transmission system where primary and secondary signal paths are provided. For dual path alarm transmission systems, loss of both signal paths is indicated as a fault at the CIE. However, it is not necessary to indicate loss of a single transmission path at the CIE.

q) Where the alarm transmission path relies upon a physical TCP/IP or similar data connection, the following recommendations apply.

1) Final connections to the alarm routing equipment should be secured against unauthorized disconnection.

2) Power supplies for routing equipment within the premises on which alarm transmission depends should conform to the recommendations of 25.4e).

NOTE 12 Where there is a dual path alarm transmission system, the recommendations contained in 15.2q)2) need only be applied to one of the transmission systems.

3) The physical data network cable used for alarm transmission within the building should be differentiated from other services by colour.

NOTE 13 Where the network cable cannot conform to the recommendations of 15.2q)3), or where local data network reliability is a concern, a dual path alarm transmission system would be beneficial."

8. REFERENCES

- EN 54-21 :2006 Fire detection and fire alarm systems - Part 21: Alarm transmission and fault warning routing equipment
- BS EN 50136-1-1:1998 Alarm systems - Alarm transmission systems and equipment Part 1-1: General requirements for alarm transmission systems
- BS EN 50136-1-2:1998 Alarm systems. Alarm transmission systems and equipment - Requirements for systems using dedicated alarm paths.
- BS EN 50136-1:2012+A1:2018 Alarm systems - Alarm transmission systems and equipment Part 1: General requirements for alarm transmission systems
- PD 6669:2017 Guidance for the provision of Alarm Transmission Systems (ATS) for Alarm Systems in the UK
- BS 5839-1:2017 Fire detection and fire alarm systems for buildings Part 1: Code of Practice for design, installation, commissioning, and maintenance of systems in non-domestic premises

DISCLAIMER

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