STANDARD

ISA-18.1-1979 (R2004)

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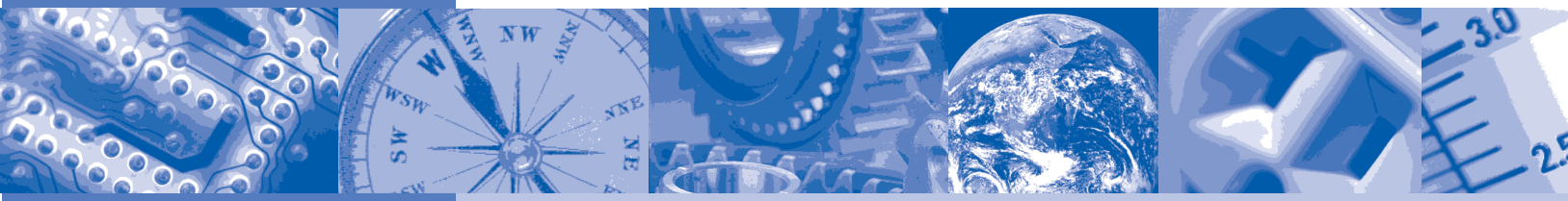

Annunciator Sequences and Specifications

Reaffirmed 25 February 2004

ISA–The Instrumentation, Systems, and Automation Society

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ISA-18.1-1979 (R2004)
Annunciator Sequences and Specifications

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Preface

This preface is included for informational purposes and is not part of ISA-18.1-1979 (R2004).

This standard has been prepared as part of the service of ISA toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static, but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board, ISA, 67 Alexander Drive, P.O. Box 12277, Research Triangle Park, North Carolina 27709, Telephone (919) 549-8411, e-mail: standards@isa.org.

Based on work started in 1955 by a survey committee titled Instrument Alarms and Interlocks, the 8D-RP18 Committee on Annunciator Systems of the Production Processes was formed in 1969. Tentative Recommended Practice ISA-RP18.1, titled Specifications and Guides for the Use of General Purpose Annunciators, was completed by that Committee in 1965.

The committee, reactivated as Committee SP18, Instrument Signals and Alarms, began revising ISA-RP18.1 in 1976 to reflect current industry practice for annunciators; in 1991, the Nuclear Power Plant Standards Committee, SP67, assumed responsibility for the reaffirmation of this standard.

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1 Purpose

The purpose of this Standard is to establish uniform annunciator terminology, sequence designations, and sequence presentation and to assist in the preparation of annunciator specifications and documentation.

This Standard is intended to improve communications among those that specify, distribute, manufacture, or use annunciators.

2 Scope

This Standard is primarily for use with electrical annunciators that call attention to abnormal process conditions by the use of individual illuminated visual displays and audible devices. Annunciators can range from a single annunciator cabinet, to complex annunciator systems with many lamp cabinets and remote logic cabinets.

The sequence designations provided can be used to describe basic annunciator sequences and also many sequence variations. This Standard lists types of information that should be included in annunciator specifications and types of documents that should be provided by manufacturers; however, detailed design requirements and documentation formats are beyond the scope of this Standard.

3 Definition of terms

The following are terms and their definitions that have special meaning in relation to annunciators. Commonly used alternate terms are shown in parentheses. Defined terms used in other definitions are in italics to provide a cross-reference.

acknowledge: the *sequence action* that indicates recognition of a new *alarm*.

active alarm point: see *alarm point*.

alarm: 1. an abnormal *process condition*. 2. the *sequence state* when an abnormal *process condition* occurs. 3. a device that calls attention to the existence of an abnormal *process condition*. See *annunciator*. Types of *alarm* include:

> **momentary**: an *alarm* that returns to normal before being acknowledged.
>
> **maintained**: an *alarm* that returns to normal after being acknowledged.

alarm module (point or sequence module): a plug-in assembly containing the sequence logic circuit. Some *alarm* modules also contain *visual display* lamps or lamps and *windows*.

alarm point: the sequence logic circuit, *visual display*, auxiliary devices, and internal wiring related to one *visual display*. Types of *alarm point* include:

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active: an *alarm point* that is wired internally and completely equipped. The *window* is labeled to identify a specific monitored variable.

spare: an *alarm point* that is wired internally and completely equipped. The *window* is not labeled to identify a monitored variable.

future (blank): an *alarm point* that is wired internally and equipped except for the plug-in *alarm module.* The *window* is not labeled to identify a monitored variable.

alert: see *process condition* and *sequence state*.

analog input point: an *alarm point* for use with an analog monitored variable signal, usually current or voltage. The logic circuit initiates an *alarm* when the analog signal is above or below a set point.

annunciator: a device or group of devices that call attention to changes in *process conditions* that have occurred. An annunciator usually calls attention to abnormal *process conditions*, but may be used also to show normal process status. Usually included are sequence logic circuits, labeled *visual displays, audible devices,* and manually operated *pushbuttons*.

audible device: a device that calls attention by sound to the occurrence of abnormal *process conditions*. An audible device may also call attention to return to normal conditions.

audible device follower: see *auxiliary output*.

automatic reset: see *reset*.

auxiliary contact: see *auxiliary output*.

auxiliary output (auxiliary contact): An output signal operated by a single *alarm point* or group of points for use with a remote device. Types of auxiliary output include:

field contact follower: an auxiliary output that operates while the *field contact* indicates an abnormal *process condition*.

lamp follower: an auxiliary output that operates while the *visual display* lamps indicate an *alarm*, silenced, or acknowledged state.

audible device follower (horn relay contact): an auxiliary output that operates while the common *alarm audible device* operates.

reflash: an auxiliary output that operates when any one of a group of *alarm points* indicates an abnormal *process condition*. The output usually returns to normal briefly when each *alarm point* changes to an abnormal *process condition* and returns to normal when all *alarm points* in the group indicate normal *process conditions*.

blank alarm point: see *alarm point*.

field contact (trouble or signal contact): the electrical contact of the device sensing the *process condition.* The contact is either open or closed. Annunciator field contacts are identified in relation to *process conditions* and annunciator operation, not the disconnected position of the devices. Types of field contact include:

normally open (NO): a field contact that is open for a normal *process condition* and closed when the *process condition* is abnormal.

normally closed (NC): A field contact that is closed for a normal *process condition* and open when the *process condition* is abnormal.

field contact follower: see *auxiliary output*.

field contact voltage (trouble or signal contact voltage): the voltage applied to *field contacts*.

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first alert: see *first out*.

first out (first alert): a *sequence* feature that indicates which of a group of *alarm points* operated first.

first out reset: see *reset*.

flasher: a device that causes *visual displays* to turn on and off repeatedly. Types of flashing include fast flashing, flashing, slow flashing, and intermittent flashing.

functional test: see *test*.

future alarm point: see *alarm point*.

horn relay contact: see *auxiliary output*.

integral logic annunciator: an *annunciator* that includes *visual displays* and sequence logic circuits in one assembly.

lamp cabinet: a cabinet containing *visual displays* only.

lamp follower: see *auxiliary output*.

lamp test: see *test*.

lock-in: a *sequence* feature that retains the alarm state until acknowledged when the abnormal *process condition* is *momentary*.

logic cabinet: a cabinet containing logic circuits and no *visual displays*.

maintained alarm: see *alarm*.

manual reset: see *reset*.

momentary alarm: see *alarm*.

multiple input: see *reflash*.

nameplate: see *window*.

normally closed (NC): see *field contact*.

normally open (NO): see *field contact.*

operational test: see *test*.

point module: see *alarm module*.

process condition: the condition of the monitored variable. The process condition is either normal or abnormal (*alarm*, alert, or off-normal).

pushbutton: A momentary manual switch that causes a change from one *sequence state* to another. Pushbutton actions include *silence, acknowledge, reset, first out reset*, and *test*.

reflash (multiple input): 1. an auxiliary logic circuit that allows two or more abnormal *process conditions* to initiate or reinitiate the *alarm state* of one *alarm point* at any time. The *alarm point* cannot return to normal until all related *process conditions* return to normal. 2. one type of *auxiliary output*.

remote logic annunciator: an *annunciator* that locates *visual displays* and sequence logic circuits in separate assemblies.

reset: the *sequence action* that returns the *sequence* to the normal state. Types of reset include:

> **automatic**: reset occurs after *acknowledge* when the *process condition* returns to normal.
>
> **manual**: reset occurs after *acknowledge* when the *process condition* has returned to normal and the reset *pushbutton* is operated.

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first out: reset of the *first out* indication occurs when the *acknowledge* or *first out* reset *pushbutton* is operated, whether the *process condition* has returned to normal or not, depending on the sequence.

response time: the time period between the *process condition* becoming abnormal and initiation of the *alarm* state. The minimum *momentary alarm* duration required for *annunciator* operation.

return alert: see *ringback*.

ringback (return alert): a *sequence* feature that provides a distinct visual or audible indication or both when the *process condition* returns to normal.

sequence: the chronological series of actions and states of an *annunciator* after an abnormal *process condition* or manual *test* initiation occurs.

sequence action: a signal that causes the *sequence* to change from one *sequence state* to another. Sequence actions include *process condition* changes and manual operation of *pushbuttons*.

sequence diagram: a graphic presentation that describes *sequence actions* and *sequence states*.

sequence module: see *alarm module*.

sequence state: the condition of the *visual display* and *audible device* provided by an *annunciator* to indicate the *process condition* or *pushbutton* actions or both. Sequence states include normal, *alarm* (alert), silenced, acknowledged, and *ringback*.

sequence table: a presentation that describes *sequence actions* and *sequence states* by lines of statements arranged in columns.

signal contact: see *field contact*.

signal contact voltage: see *field contact voltage.*

silence: the *sequence action* that stops the sound of the *audible device*.

spare alarm point: see *alarm point*.

test: an *annunciator sequence* initiated by operation of the test *pushbutton* to reveal lamp or circuit failure. Types of test include:

operational (functional): test of the *sequence, visual display* lamps, *audible devices*, and *pushbuttons*.

lamp: test of the *visual display* lamps.

trouble contact: see *field contact*.

trouble contact voltage: see *field contact voltage*.

visual display: that part of an *annunciator* or *lamp cabinet* that indicates the *sequence state*. Usually consists of an enclosure containing lamps behind a translucent *window*. The lamps can be off, flashing, or on.

window (nameplate): a component of a *visual display* made from a translucent material that is illuminated from the rear and labeled to identify the monitored variable.

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4 Sequences

4.1 Operation

Annunciators usually call attention to abnormal process conditions by the use of individual illuminated visual displays and audible devices. Annunciators may also be used to show normal process status. Changes from one annunciator sequence state to another are caused by changes in process conditions and also by manual operation of pushbuttons. The new sequence state may be dependent on the process condition that exists at the time pushbuttons are operated. Process condition changes are usually sensed by field contacts.

The visual displays usually flash to indicate abnormal process conditions and change to on when alarms are acknowledged. Additional types of flashing can indicate that process conditions have returned to normal or which of a group of alarm points operated first. All of the alarm points of an annunciator usually use the same sequence; however, different sequences can be used for individual alarm points or groups of points in one annunciator.

In this Standard, sequences making use of more than one indication device as a part of each visual display to indicate the sequence state are considered to be special because of their many variations and relatively infrequent use. Examples include the use of lamps of different colors to indicate different sequence states or which is the first of a group of alarms.

4.2 Presentation

Annunciator sequence tables describe the operation of annunciators, but often do not clearly indicate all aspects of the sequences. Examples include failure to indicate the sequence actions and states when process conditions return to abnormal again before the annunciator is reset and also when pushbuttons are operated out of the normal sequence. A sequence diagram format is used in this Standard to allow annunciator sequences to be defined completely and analyzed logically. See Figures 2 to 8.

Sequence diagrams include a block for each annunciator sequence state. The process condition, the sequence state, and the visual display and audible device conditions when in that state are indicated in each block. The blocks are arranged to describe the annunciator sequence from the normal state, through the other sequence states, and back to the normal state again. Arrows between the blocks indicate all possible sequence actions that can cause a change from one sequence state to another. Sequence actions include process condition changes and manual operation of pushbuttons.

Sequence tables are also used in this Standard since it is not always convenient to use sequence diagrams. These sequence tables are patterned after the sequence diagrams to describe all aspects of the annunciator operation. See Figures 2 to 8.

The sequence tables include a line for the initial normal state and also a line for each possible sequence action that can cause a change from one sequence state to another. The reference line numbers in the tables are identified by suffixes A and B when the new sequence state depends on the process condition that exists at the time pushbuttons are operated. References to other lines in the table are used to avoid indicating each sequence state and the related visual display and audible device conditions more than once.

When annunciators require auxiliary outputs, the output operation should be added to sequence diagrams and sequence tables or the operation should be defined by notes. The operation of auxiliary outputs during annunciator test should be defined also.

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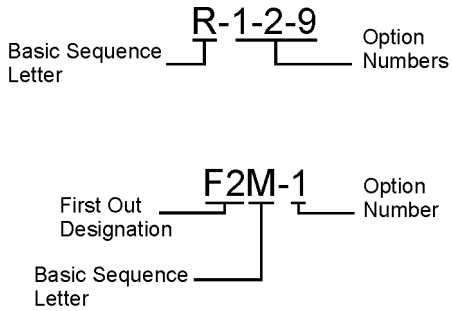
Since most annunciators include a test pushbutton and operational test of the sequence, visual display lamps, audible devices, and pushbuttons, the sequences in this Standard include operational test as a standard feature.

4.3 Designation method

Annunciators call attention to changes in process conditions by different visual display and audible device arrangements and by a wide variety of operating sequences. The choice depends on the requirements or preferences of the users and also on the standard or special annunciator designs that are available.

This Standard provides a sequence designation method using letters for basic sequences in common use, numbers for common sequence options, and first out designations. Combinations of letters and numbers can define many different sequence variations. Sequence designation examples and a summary of the basic sequence letters, option numbers, and first out designations are provided in Figure 1. This Standard does not designate any particular sequences as being standard.



Basic Sequence Letter	Key Words
A	Automatic Reset
M	Manual Reset
R	Ringback

(See 4.4 for descriptions.)

First Out Designation	Key Words
F1	No Subsequent Alarm State
F2	No Subsequent Alarm Flashing
F3	First Out Flashing and Reset Pushbutton

(See 4.6 for descriptions.)

Option Number	Key Words
1	Silence Pushbutton
2	Silence Interlock
3	First Out Reset Interock
4	No Lock-In
5	No Flashing
6	No Audible
7	Automatic Alarm Silence
8	Common Ringback Audible
9	Automatic Ringback Silence
10	No Ringback Audible
11	Common Ringback Visual
12	Automatic Momentary Ringback
13	Dim Lamp Monitor
14	Lamp Test

(See 4.5 for descriptions.)

Figure 1 — Annunciator sequence designations

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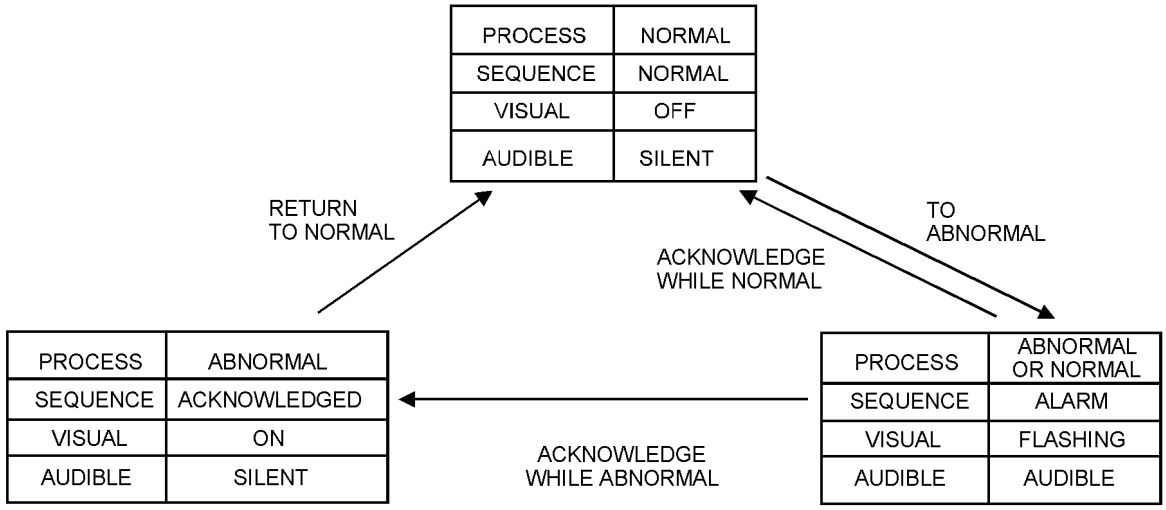
SEQUENCE DIAGRAM



SEQUENCE TABLE

LINE	PROCESS CONDITION	PUSHBUTTON OPERATION	SEQUENCE STATE	VISUAL DISPLAY	ALARM AUDIBLE DEVICE	REMARKS
1	NORMAL	-	NORMAL	OFF	SILENT	
2	ABNORMAL	-	ALARM	FLASHING	AUDIBLE	LOCK-IN
3A	ABNORMAL	ACKNOWLEDGE	ACKNOWLEDGED	ON	SILENT	MAINTAINED ALARM
3B	NORMAL	ACKNOWLEDGE	TO LINE 4			MOMENTARY ALARM
4	NORMAL	-	NORMAL	OFF	SILENT	AUTOMATIC RESET

SEQUENCE FEATURES

1 - ACKNOWLEDGE AND TEST PUSHBUTTONS.
2 - ALARM AUDIBLE DEVICE.
3 - LOCK-IN OF MOMENTARY ALARMS UNTIL ACKNOWLEDGED.
4 - THE AUDIBLE DEVICE IS SILENCED AND FLASHING STOPS WHEN ACKNOWLEDGED.
5 - AUTOMATIC RESET OF ACKNOWLEDGED ALARM INDICATIONS WHEN PROCESS CONDITIONS RETURN TO NORMAL.
6 - OPERATIONAL TEST.

Figure 2 — Sequence A, automatic reset

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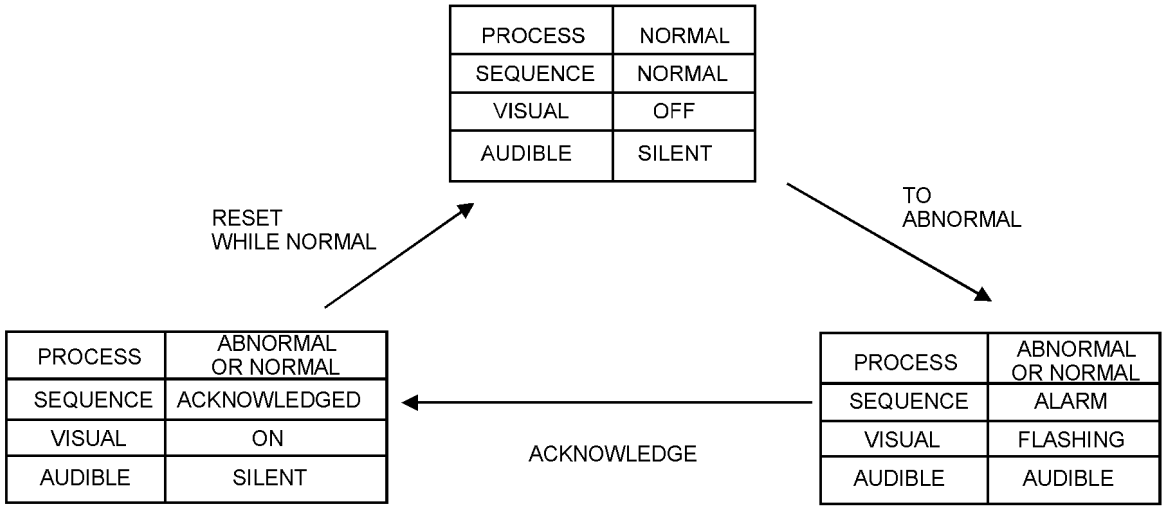
SEQUENCE DIAGRAM



SEQUENCE TABLE

LINE	PROCESS CONDITION	PUSHBUTTON OPERATION	SEQUENCE STATE	VISUAL DISPLAY	ALARM AUDIBLE DEVICE	REMARKS
1	NORMAL	—	NORMAL	OFF	SILENT	
2	ABNORMAL	—	ALARM	FLASHING	AUDIBLE	LOCK-IN
3	ABNORMAL OR NORMAL	ACKNOWLEDGE	ACKNOWLEDGED	ON	SILENT	MANUAL RESET REQUIRED
4A	ABNORMAL	RESET	TO LINE 3			
4B	NORMAL	RESET	NORMAL	OFF	SILENT	MANUAL RESET

SEQUENCE FEATURES

1 - ACKNOWLEDGE, RESET, AND TEST PUSHBUTTONS.
2 - ALARM AUDIBLE DEVICE.
3 - LOCK-IN OF MOMENTARY ALARMS UNTIL ACKNOWLEDGED.
4 - THE AUDIBLE DEVICE IS SILENCED AND FLASHING STOPS WHEN ACKNOWLEDGED.
5 - MANUAL RESET OF ACKNOWLEDGED ALARM INDICATIONS AFTER PROCESS CONDITIONS RETURN TO NORMAL.
6 - OPERATIONAL TEST.

Figure 3 — Sequence M, manual reset

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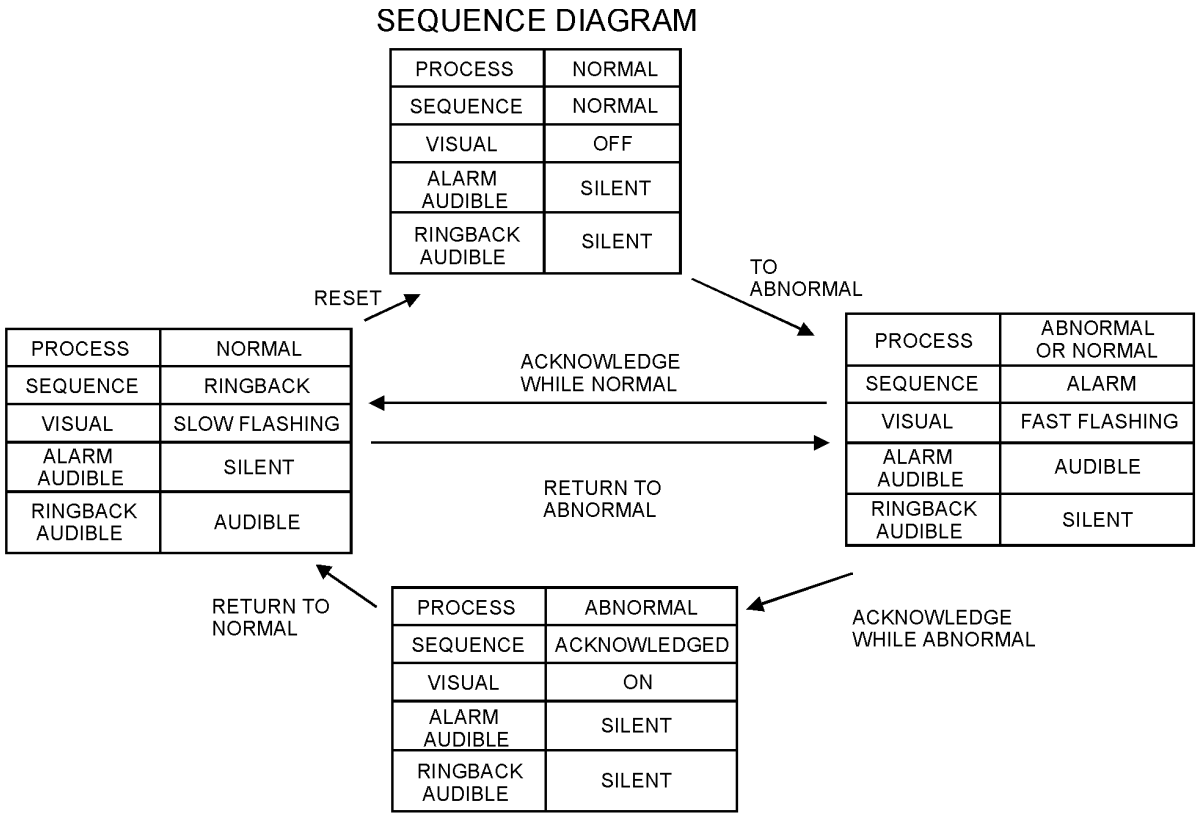

SEQUENCE TABLE

LINE	PROCESS CONDITION	PUSHBUTTON OPERATION	SEQUENCE STATE	VISUAL DISPLAY	ALARM AUDIBLE DEVICE	RINGBACK AUDIBLE DEVICE	REMARKS
1	NORMAL	—	NORMAL	OFF	SILENT	SILENT	
2	ABNORMAL	—	ALARM	FAST FLASHING	AUDIBLE	SILENT	LOCK-IN
3A	ABNORMAL	ACKNOWLEDGE	ACKNOWLEDGED	ON	SILENT	SILENT	MAINTAINED ALARM
3B	NORMAL	ACKNOWLEDGE	TO LINE 4				MOMENTARY ALARM
4	NORMAL	—	RINGBACK	SLOW FLASHING	SILENT	AUDIBLE	MANUAL RESET REQUIRED
5	ABNORMAL	—	TO LINE 2				RETURN TO ABNORMAL
6	NORMAL	RESET	NORMAL	OFF	SILENT	SILENT	MANUAL RESET

SEQUENCE FEATURES

1 - ACKNOWLEDGE, RESET, AND TEST PUSHBUTTONS.
2 - ALARM AND RINGBACK AUDIBLE DEVICES.
3 - LOCK-IN OF MOMENTARY ALARMS UNTIL ACKNOWLEDGED.
4 - THE AUDIBLE DEVICE IS SILENCED AND FAST FLASHING STOPS WHEN ACKNOWLEDGED.
5 - RINGBACK VISUAL AND AUDIBLE INDICATIONS WHEN PROCESS CONDITIONS RETURN TO NORMAL.
6 - MANUAL RESET OF RINGBACK INDICATIONS.
7 - OPERATIONAL TEST.

Figure 4 — Sequence R, ringback

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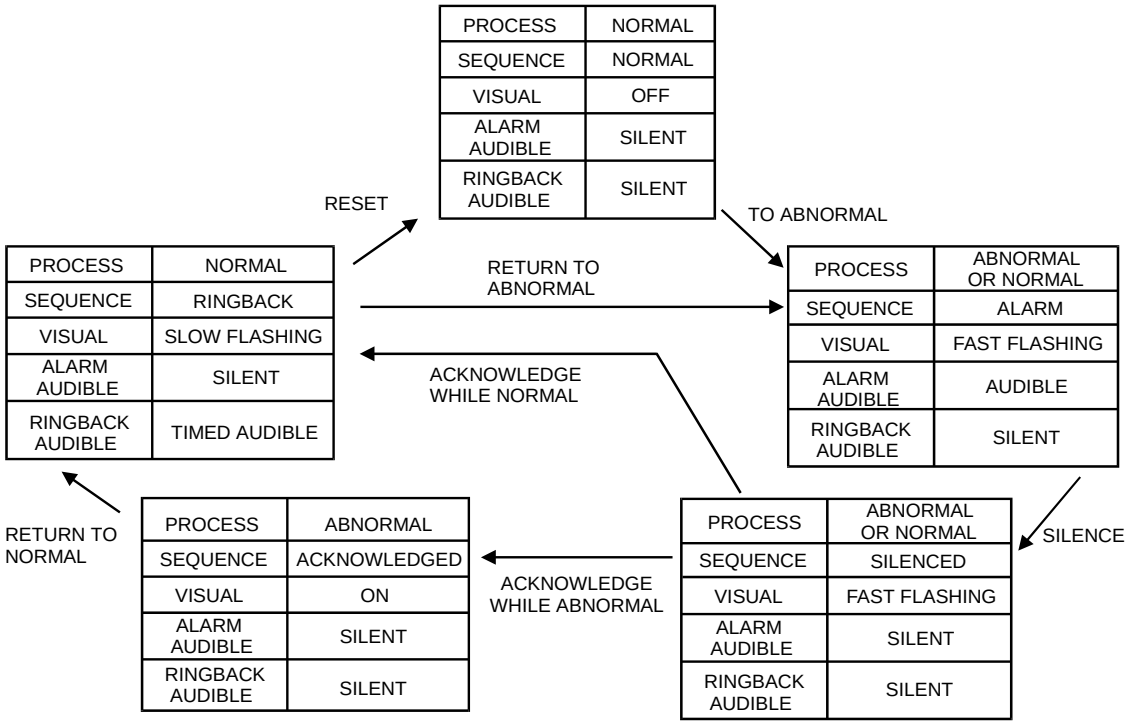
SEQUENCE DIAGRAM



SEQUENCE TABLE

LINE	PROCESS CONDITION	PUSHBUTTON OPERATION	SEQUENCE STATE	VISUAL DISPLAY	ALARM AUDIBLE DEVICE	RINGBACK AUDIBLE DEVICE	REMARKS
1	NORMAL	—	NORMAL	OFF	SILENT	SILENT	
2	ABNORMAL	—	ALARM	FAST FLASHING	AUDIBLE	SILENT	LOCK-IN
3	ABNORMAL OR NORMAL	SILENCE	SILENCED	FAST FLASHING	SILENT	SILENT	LOCK-IN
4A	ABNORMAL	ACKNOWLEDGE	ACKNOWLEDGED	ON	SILENT	SILENT	MAINTAINED ALARM
4B	NORMAL	ACKNOWLEDGE	TO LINE 5				MOMENTARY ALARM
5	NORMAL	—	RINGBACK	SLOW FLASHING	SILENT	TIMED AUDIBLE	MANUAL RESET REQUIRED
6	ABNORMAL	—	TO LINE 2				RETURN TO ABNORMAL
7	NORMAL	RESET	NORMAL	OFF	SILENT	SILENT	MANUAL RESET

SEQUENCE FEATURES

1 - SILENCE, ACKNOWLEDGE, RESET, AND TEST PUSHBUTTONS.
2 - ALARM AND RINGBACK AUDIBLE DEVICES.
3 - LOCK-IN OF MOMENTARY ALARMS UNTIL ACKNOWLEDGED.
4 - OPTION 1 - SILENCE PUSHBUTTON TO SILENCE THE ALARM AUDIBLE DEVICE WHILE RETAINING FAST FLASHING INDICATIONS.
5 - OPTION 2 - SILENCE INTERLOCK TO REQUIRE OPERATION OF THE SILENCE PUSHBUTTON BEFORE THE ACKNOWLEDGE PUSHBUTTON.
6 - RINGBACK VISUAL AND AUDIBLE INDICATIONS WHEN PROCESS CONDITIONS RETURN TO NORMAL.
7 - OPTION 9 - AUTOMATIC RINGBACK SILENCE TO SILENCE THE RINGBACK AUDIBLE DEVICE AFTER A SET TIME.
8 - MANUAL RESET OF RINGBACK INDICATIONS.
9 - OPERATIONAL TEST.

Figure 5 — Sequence R-1-2-9, ringback with options

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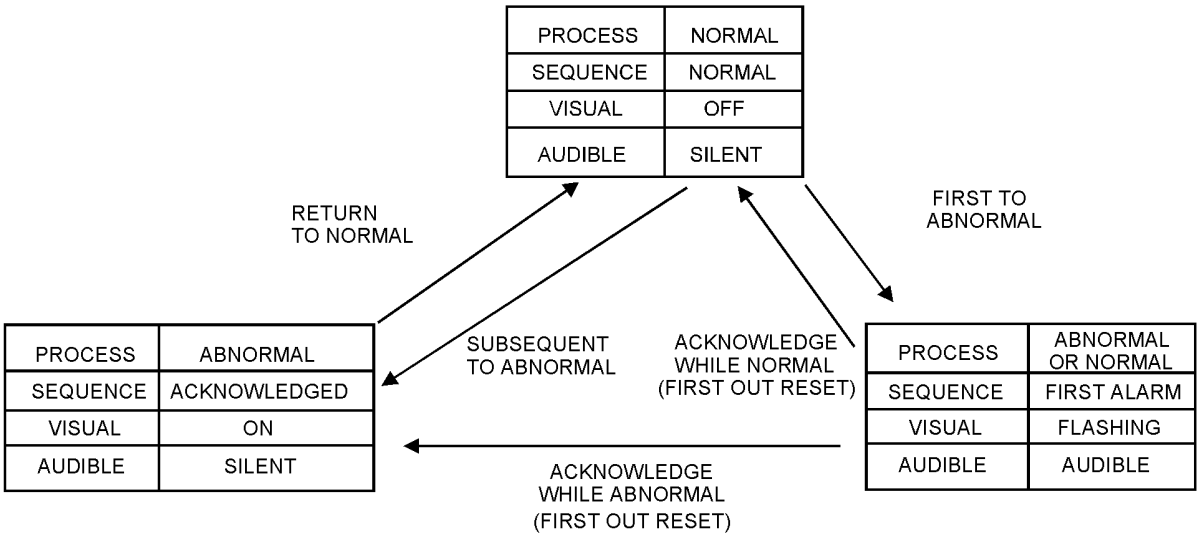
SEQUENCE DIAGRAM



SEQUENCE TABLE

LINE	PROCESS CONDITION		PUSHBUTTON OPERATION	SEQUENCE STATE	VISUAL DISPLAY	ALARM AUDIBLE DEVICE	REMARKS
1	NORMAL		—	NORMAL	OFF	SILENT	
2	FIRST	ABNORMAL	—	FIRST ALARM	FLASHING	AUDIBLE	LOCK-IN
3	SUB.	ABNORMAL	—	ACKNOWLEDGED	ON	SILENT	NO LOCK-IN
4A	FIRST	ABNORMAL	ACKNOWLEDGE	TO LINE 3			MAINTAINED ALARM FIRST OUT RESET
4B	FIRST	NORMAL	ACKNOWLEDGE	TO LINE 5			MOMENTARY ALARM FIRST OUT RESET
5	NORMAL		—	NORMAL	OFF	SILENT	AUTOMATIC RESET

SEQUENCE FEATURES

1 - ACKNOWLEDGE AND TEST PUSHBUTTONS.
2 - ALARM AUDIBLE DEVICE.
3 - LOCK-IN OF MOMENTARY FIRST ALARM UNTIL ACKNOWLEDGED. NO LOCK-IN OF MOMENTARY SUBSEQUENT ALARMS.
4 - FLASHING AND AUDIBLE INDICATIONS FOR FIRST ALARM ONLY. NEW SUBSEQUENT ALARMS GO TO THE ACKNOWLEDGE STATE.
5 - FIRST OUT INDICATION IS RESET AND THE AUDIBLE IS SILENCED WHEN ACKNOWLEDGED.
6 - AUTOMATIC RESET OF ACKNOWLEDGED ALARM INDICATIONS WHEN PROCESS CONDITIONS RETURN TO NORMAL.
7 - OPERATIONAL TEST.

Figure 6 — Sequence F1A, automatic reset first out with no subsequent alarm state

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