

2. Message Types

Two types of messages shall be transmitted on the channel:

Supervisory Messages to supervise the channel and direct the flow of device messages.

Device Messages to control operation of equipment functions. This type of message shall be transmitted only within standard message blocks or during device defined communications modes. Details of device messages will be the subject of another document now in preparation.

3. Tributary Addresses

Tributary addresses shall consist of two bytes: the most significant byte which is transmitted first, and the least significant byte. The most significant bit of both bytes shall be set to binary 1. This provides an address range starting at 8080_h. Each tributary shall be assigned two unique addresses, a SELECT address and a POLL address.

3.1 Select Address. An address in which the least significant bit of the least significant byte equals binary 0 is a SELECT address.

3.2 Poll Address. An address in which the least significant bit of the least significant byte equals binary 1 is a POLL address.

3.3 Group Addresses. Address pairs 8080-8081_h and 8082-8083_h through 809E-809F_h are reserved as GROUP SELECT addresses. The addresses in which the least significant bit of the least significant byte equals binary 1 (POLL address) shall not be used but are retained in the address numbering scheme for software considerations.

3.4 Discrete Addresses. Tributary addresses shall start at 80A0-80A1_h. Precisely 8176 discrete tributary address pairs are available.

3.5 Address Allocation Table:

8080-8081 _h	Group select—all call
8082-809F _h	Group select—groups 1 through 15
80A0-80FF _h	48 tributaries
8180-81FF _h	64 tributaries
8280-82FF _h	64 tributaries
⋮	
FF80-FFFF _h	64 tributaries

scope. This recommended practice defines the supervisory protocol used within a general purpose communication channel of an interface system which transports digital data and control signals between equipment utilized in the production, post-production, and/or transmission of visual and aural information. It is intended that the supervisory protocol described in this practice be part of an overall system, allowing interconnection of programmable and nonprogrammable equipment as required to configure an operational system with a defined function, and to allow rapid reconfiguration of a system to provide more than one defined function utilizing a given group of equipment.

The primary intent of this practice is to establish supervisory procedures of the communication channel for the purpose of transmitting control messages to equipment by external means. (The contents of the messages are not defined.) This practice, or sections thereof, may be applied to the interconnection of elements within an item of equipment.

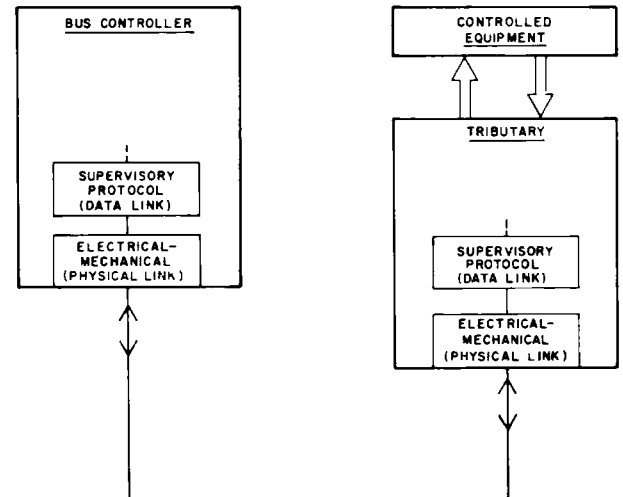
Definitions. (See Fig. 1.) For the purposes of this practice, the following definitions apply:

Bus Controller: Each system contains one bus controller which supervises all tributaries in the system. Supervision is exercised through the use of this supervisory protocol.

Byte: A byte consists of eight bits of information. Bits used to effect transmission such as byte start, parity, or end are not part of the byte.

Tributary: A tributary transfers messages to and from controlled equipment via the interface system. The tributary is distinct from the function of the controlled equipment and exists to transfer control messages between the communication channel and the equipment.

Word: A word consists of a byte and associated bits used to effect transmission such as start, parity, or end.



NOTE: Parentheses indicate terms used in Draft International Standard Open Interconnection, Basic Reference Model, ISO/DIS 7498.

Fig. 1 System Elements

4. Tributary Operational States

A tributary shall be in one of five major operational states:

IDLE: The tributary shall not perform any communications. This state shall be exited only in response to BREAK.

ACTIVE: Prerequisite for transition to other operational states. The tributary shall enter this state whenever BREAK is received.

POLL: The tributary shall transmit a single status byte to the bus controller.

SELECT: A single tributary shall enter a communications mode with the bus controller.

GROUP SELECT: All tributaries or a selected group of tributaries shall enter a communications mode with the bus controller.

5. Supervisory Messages

Tributaries shall be directed to operational states through various communications sequences by supervisory messages as shown in Fig. 2. Supervisory messages consist of the following elements:

BREAK: Shall drive all tributaries to the ACTIVE state. (See Proposed American National Standard Electrical and Mechanical Characteristics for

Digital Control Interface, code.)

(ADDR-POLL): A tributary POLL shall drive the address to the POLL state.

(ADDR-SELECT): A tributary (ADDR-SEL) shall drive the address to the SELECT state.

(GROUP ADDR-SEL): A group of tributaries shall drive a group of tributaries to the SELECT state.

Supervisory Characters: In communications sequences and provide status characters are single characters 00_h-7F_h. Supervisory characters:

- 01_h (GRP) Group assign
- 02 (STX) Start of message
- 03 (ESC) Escape
- 04 (ACK) Acknowledgment
- 05 (NAK) Not acknowledged
- 06 (BSY) Busy
- 07 (RST) Reset
- 08 (SVC) Service request

All other supervisory characters for use of other characters for noncompliant with this specification.

tributary shall exit SELECT on receipt of NAK or in response to the exceptional conditions noted in 6.4.1.1 and 6.4.1.2 above.

select.

of tributaries shall enter the GROUP SELECT state on receipt of their group select (GROUP ADDR-SEL). All tributaries assigned to the group shall transition to Tributaries in the GROUP SELECT shall execute the communications sequences detailed in 6.5.1.1 and 6.5.1.2 as directed by the bus controller.

ive Message. Supervisory character STX shall be followed by a message block as defined in 6.4.1.1.

tributary returns to GROUP SELECT after error-free reception of the block; response shall be transmitted.

encountering an error during reception, a tributary shall respond with NAK, then transition to IDLE.

transmission from the bus controller is interrupted for more than the timeout period, tributaries shall transition to IDLE.

Defined Communications. Supervisory character ESC shall release a group to user defined communications in accordance with 6.3. Tributaries shall exit this mode only in response to BREAK.

tributaries shall exit GROUP SELECT on receipt of BREAK or in response to the exceptional conditions noted in 6.5.1.1.

Operational

Synchronization. The bus controller shall transmit BREAK when power is turned on and during reset.

Response Timeout. The bus controller shall transmit BREAK when a tributary fails to respond within the following time-out periods:

- Response to ADDR-POLL, GRP (#) . ESC 6 words
- Transmission of STX (msg) 140 words

of This Practice. This practice specifies the supervisory protocol used within the communication channel. The protocol is the sequence of characters used to transfer messages between the bus controller and tributaries, provide recovery from error conditions, and generally supervise the usage of the communication channel. This practice is concerned only with channel supervisory electrical/mechanical characteristics are specified in separate standards since many types of systems which can deliver eight-bit binary bytes and a unique BREAK condition can operate under the supervision of the protocol. Message content is defined by standards which are independent of electrical/mechanical and supervisory characteristics of the communication channel.

8.2 System Configurations. This supervisory protocol permits supervision of point-to-point and multipoint systems.

A point-to-point configuration is one in which a communication channel is connected to only one tributary. The bus controller may be connected to more than one channel, each having one tributary. This configuration has the advantage of speed since the dedicated channels provide access to all tributaries simultaneously.

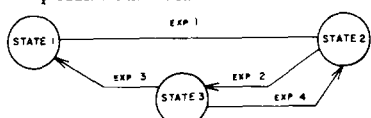
The multipoint bus configuration is one in which more than one tributary is connected to a channel. This configuration has the advantage of reduced cabling costs and complexity. The main disadvantage of multipoint is that messages to different tributaries must queue up and be sent serially on the bus. This configuration is therefore slower in response time than point-to-point systems.

8.3 State Diagrams. The supervisory procedures are described by means of state diagrams that show how the interfacing hardware and software in a tributary follow sequences of bytes as they are received from the communication channel.

8.3.1 Each state (condition) that a tributary can assume is represented graphically as a circle; major states are identified by an upper case label or mnemonic within the circle.



8.3.2 All possible transitions between states are represented by arrows between the states; each transition is qualified by an expression which will produce the transition.



8.3.3 Expressions can be messages received from or transmitted to the communication channel, or local messages generated within the tributary.

8.3.3.1 Messages received from the channel are represented by R followed by the received message in parentheses:



indicates transition from state ONE to state TWO on receipt of the message GRP.

8.3.3.2 Messages transmitted to the bus are represented by T followed by the transmitted message in parentheses:



indicates transition from state THREE to state FOUR after transmitting the message ACK.

8.3.3.3 Local messages are represented by lower case labels:



indicates transition from state FIVE to state SIX when reset occurs.

8.4 Channel Synchronization. Data density is maximized by allowing the transmission of binary data in all device messages. This means that there must be no combination of transmitted bytes which can be interpreted as a channel synchronization command. The channel synchronization command is a unique transmission sequence called BREAK. This sequence cannot be accidentally generated by normal communications. Tributaries receiving BREAK are required to immediately transfer to the ACTIVE state regardless of what they are currently doing in relation to the communication channel. On power up, a tributary enters the IDLE state and ignores all bus transactions until it receives BREAK. Electrical specifications appropriate for use with this supervisory protocol assure that BREAK cannot be generated accidentally.

8.5 Supervisory Message Components. The protocol uses BREAK, tributary addresses, and a small number of predefined supervisory characters to manage the communication channel. Since the addresses and supervisory characters are eight-bit binary bytes, they must be recognized by being received immediately after BREAK. The only supervisory message that is unconditionally recognizable is the BREAK sequence.

8.5.1 Tributary Addresses. Tributary addresses consist of two bytes. Up to 8176 tributaries can be addressed uniquely. A one-byte addressing scheme would have served most small system applications with a saving in channel overhead, but complex reassignment strategies would have to be employed in order to accommodate larger users.

The address bytes are characterized by a 1 in the most significant bit. Each tributary is assigned two addresses, a SELECT address and a POLL address. The least significant bit of the least significant byte is set to 0 for SELECT and 1 for POLL.

A unique two-byte address serves as an all-call SELECT address. When this address is transmitted all tributaries in a multipoint system simultaneously receive and act on system messages.

Tributaries can be assigned to one or more of fifteen group SELECT addresses. These addresses allow simultaneous operation with selected groups of tributaries in multipoint systems similar to all-call.

During all-call or group operation, transmission by the tributaries is allowed only when an error

condition is encountered. Transmission could cause channel contention. When error conditions occur, tributaries transmit the supervisory character NAK on reception of the NAK or channel contention alert. An error condition in one tributary (ies) has encountered the nature of the error.

8.5.2 Supervisory Characters. Supervisory characters are those characters used as signals which the most significant bits of this protocol. Supervisory characters for as such use would interfere with other systems or cause operational failures. Functions are added to the structure.

8.6 Poll Sequence. The POLL sequence verifies tributary presence in point systems, the POLL sequence is to be scanned quickly. Attention is required by any

Status characters transmitted from the bus controller of condition. Characters associated with this protocol are detailed in 6.3. The highest priority character applicable to its condition applies. All status characters (SVC) apply to condition. SVC is a parameter which indicates a service controlled through the interface used to identify and parameter.

8.7 Message Receive/Transmit. Messages are received or transmitted by means of the message sequence from the SELECT address offers message lengths of checksum protection. Group receive messages from the G

All equipment control and exchanged by means of dev

8.8 Escape Sequence. The escape sequence is provided for those users who are incompatible with the electrical characteristics of the interface. It requires nonstandard operating messages. Single tributaries or may be placed outside the using this sequence. The element which must be observed using this sequence is the the ACTIVE state whenever from the communication ch