

NO. 400 DATA PACKAGE  
PURPOSE AND GENERAL DESCRIPTION

1. GENERAL

1.01 This section gives a brief description of the No. 400 Data Package, and a general method of operation.

1.02 The No. 400 Data Package is a versatile, compact, 4-wire crossbar line-switching unit providing a maximum of 60 ports, and designed for installation on customer premises. Under TOUCH-TONE control, it will efficiently switch all forms of voice-band analog or digital data between data stations; between data stations and computers; between computers; or between other No. 400 Data Packages or other compatible switching systems. The switcher will serve most 2-wire or 4-wire switching plans requiring reliable two-way, point-to-point data transmission.

1.03 The maximum terminating capacity of small-switching systems is generally defined in terms of fixed line-to-trunk ratios. The No. 400 Data Package is described as a maximum 60 "port" system without reference to these ratios. Each port, or switchable termination, may be used to terminate either a 2-wire station line, a 4-wire station line, or a 4-wire trunk circuit, in any combination, as determined by traffic, transmission and facility requirements.

1.04 A rectangular switching plan is used whereby all ports have access to all other ports via one of 10 horizontal links. Uniform transmission levels are maintained throughout the switch by 44V4-type repeaters associated with each port and all switching is done on a 4-wire basis regardless of the type of facilities terminated at the port.

1.05 A restrictive-type class marking arrangement, providing up to five classes of service, may be used to segregate traffic by denying selected ports access to other ports. Class marks may also be used to deny certain ports access to Multiple Address or other restrictable features of the switch.

1.06 A permanent signal release feature makes the switcher immune to common equipment tieups caused by an excessive number of permanent signals. Each port is arranged to disconnect itself from the switcher when a permanent signal is detected on its facility, and to reconnect itself to the switch when the permanent signal clears. This leaves the common equipment free to service other ports attempting to place calls.

1.07 Four ports of the switch are dedicated to installation and maintenance testing. The first port may be used to terminate a facility to a remote testboard or other testing facility; the second port terminates in a standard 4-wire, 600 ohm, 1000 Hz milliwatt supply and the third port terminates in either a quiet termination or a loop-around test arrangement, depending on the option specified. The fourth port provides a remote monitoring over the testboard facility. The port to be monitored is put up on a manual patch to the fourth port.

1.08 Adequate test jacks are provided throughout the switch for transmission and other measurements. Transmission units and other critical circuit elements are packaged on a plug-in basis for ease of installation and maintenance replacement.

A local telephone circuit equipped with TOUCH-TONE dialing provides a means for testing any particular facility from the data pack location.

2. MARKER OPERATION

2.01 The marker circuit provides the means for establishing a connection between any line circuit and a register, a retry register, or any other line circuit through any one of the 10 links on the crossbar switch.

2.02 The link circuit provides the communications path over which a line circuit may be connected to a register, retry register, or any other line circuit.

2.03 The line circuit is the port through which you enter the switching system. It provides the supervision for the state of the line.

2.04 An off-hook condition signals the marker to select a register and set up a dial tone connection. The completion of dialing into the register will signal the marker to set up a connection between the originating port and the port corresponding to the dialed number.

2.05 The marker processes only one call at a time. A gating and preference circuit is provided to cope with simultaneous seizures.

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2.06 The gate is open when the marker is idle. One or a group of simultaneous calls for the marker closes the gate. The bids are processed on a preferential basis, serving one bid in each tens group in ascending order until all groups are served.

2.07 Only groups which were admitted while the gate was open will be served, however individual bids within these groups will still be accepted until that group is served. Only one station within the group is accepted for connection to the register and all others within the same group are rejected. This is under control of the units sequence circuit in the marker. Thus for example, station 39 bids for the tens groups and the gate is closed, however station 38 originates before this tens group is served. In this case station 38 will be served for this tens group, and station 39 excluded, with the necessity for it to bid again the next time the gate is open.

2.08 The marker stops serving originating connections when both registers are busy and waits until a register has been served for a terminating connection, thereby making it available before proceeding to serve the next tens group in preference.

2.09 The marker routes a call for a busy station to either of two retry registers if one is available. The calling station and dialed digit information is transferred to the retry register freed to continue processing originating calls. The retry register is given preference over the registers when a retry register is bidding in an effort to complete the call as quickly as possible. The calling station is given a disconnect signal if the call cannot be completed in a predetermined length of time.

2.10 The marker by way of the register instructs the calling station line circuit to return busy tone if the called station is busy and both retry registers are also busy.

2.11 The marker contains a timing circuit which starts functioning at the beginning of each marker usage. If a trouble condition is encountered and a connection is not completed within 500 milliseconds, the processing of the call is restored to its initial stages and a second trial is made. The call is disconnected if the connection is not completed within another 500 milliseconds.

2.12 The marker is designed to distinguish between several different classes of service. The calling stations class of service is stored. The marker compares the calling class of service with the called class of service. If there is no match the marker will not complete the connection and will

cause the register to remove ground from the S lead which will cause the calling station line circuit to return busy tone until the calling station goes on-hook.

2.13 A multiple address circuit may be provided which enables one station to send a message to several other stations at one time.

### 3. REGISTER

3.01 The register functions with a TOUCH-TONE receiver to store digits on all calls passing within the switching system.

3.02 When either a station or a trunk originates a call into the switching system, the marker selects and connects an idle register to it. The register transmits dial tone and initiates a ground start condition to the line or trunk. After dialing is completed, the register engages the marker to terminate the call and transmits the information needed to establish a connection to the called station or trunk to the marker. When the connection has been established, the marker releases the register.

3.03 If the marker finds the called line busy, the call is routed to the retry register.

3.04 The register allows from 7.8 to 15.5 seconds in which dialing must be completed after seizure. If dialing is not completed in this time, the register will time out, place the calling station in PS condition and release.

3.05 The register is arranged to receive tens and units information from a TOUCH-TONE Calling receiver.

3.06 When the station goes off - hook, or trunk circuit requests inward service, the associated tens relay in the marker operates. This sets off a train of events that result in the marker connecting the line through an idle link to an idle register.

3.07 When the register hold magnet closes the transmit and receive tip and ring and the sleeve of the line is cut through to the R Equalizer. L, SR & ON relays operate. The off-normal relay furnishes holding battery and ground for most of the register, closes the dial tone path and initiates a register attached condition to the calling line. This connection is known as the dial tone connection and is an indication that dialing may proceed.

3.08 The register is arranged to receive one or two digit codes for any port.

3.09 After the calling port dials the one or two digits required for identification of the called line, the register recognizes dial completion and engages the marker for completion of the call.

- (a) The digit steering relays determine when the tens and units digits have been registered, the tens digit being stored in the TD register relays and the units digit in the pulse counter and the UD register relays.
- (b) If an assigned one digit code is dialed, the register recognizes that only one digit will be dialed and engages the marker to complete the call. If the tens digit dialed is not assigned, the calling station will receive no-such-number tone from the register.
- (c) When the multiple address is the calling station and the tens digit 0 is dialed the TDO relay operating will ground the TB lead through the operated MAC relay the DC relay will not operate and the register will be abandoned.

3.10 When the digit registration is completed and the marker engaged, the register transmits the called number to the marker.

3.11 When the dial tone connection was established, the register memory lead, (SM-) in the link circuit remembered which link was used for the connection from the calling line to the register so that the same link can be reused when the call is later completed.

3.12 After the marker performs its functions in completing the call, it transmits a release signal to the register. The register then releases the register hold magnet, and makes itself available to the marker for re seizure.

3.13 If the marker encounters a busy line, the call is routed to the retry register.

#### 4. RETRY REGISTER

- 4.01 This circuit stores the called number if the called trunk, or station, is busy; holds the calling station and tries to complete the call within a specified time limit.
- 4.02 A station calling busy number is diverted to the retry register.
- 4.03 The marker gives priority to the retry register in an effort to complete the call. The retry register continues to engage the marker, approximately every eight seconds

in an effort to complete the call, for up to 100 seconds after which attempts are made to disconnect the calling station.

- 4.04 The station is abandoned and set to permanent signal if it fails to disconnect.
- 4.05 A successful retry restores the circuit to the normal condition.
- 4.06 Circuits 0 and 1 are two identical circuits enabling two calls to be held in retry at the same time.
- 4.07 Circuitry in the marker allots the retry registers for equal usage.

#### 5. MULTIPLE ADDRESS

5.01 To allow a station served by a No. 400 Data Package to simultaneously transmit messages to two or more other stations within the same switching system.

5.02 The originator touch-tone dials code "00" to set up a multiple address (MA) call. This establishes a link between this circuit and the calling station. The MA circuit immediately causes its outgoing port to establish a dial tone connection. A distinctive dial tone is then returned to the originator as a signal to TOUCH-TONE dial the address of the first station to be connected to the MA bridge.

5.03 The address is received by the Data Package register which causes a connection between the MA outgoing port and the called station. The called station responds to the ring and sends its answer back message to the originator.

5.04 After the answer back is received the called station is automatically transferred to the bridge and the originator's machine is turned off.

5.05 The originator must now re-originate within five seconds or the established connection to the MA and the stations waiting on the bridge will be disconnected.

5.06 To alert the station(s) waiting on the bridge that a MA transmission is about to be sent, the MA circuit transmits a rub-out character every four seconds and a signal to light the Restrainer lamp.

5.07 When the station re-originate, the distinctive MA dial tone is heard as a signal to TOUCH-TONE dial the address of the next station to be put on the bridge.

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5.08 This process repeats as previously described until all of the desired stations are connected and waiting on the bridge, at which time the originator TOUCH-TONE dials the "originator transfer to the bridge" code, ZERO. This causes the originator to be connected to the input of the MA bridge. Transmission of the message to all stations on THE bridge may now commence.

5.09 When the message is completed either an end-of-transmission code (EOT) or operation of the originator's CLR key will cause the MA circuit and all stations on the bridge to disconnect.

### 6. SIGNALING CIRCUITS

6.01 The 2600 Hz. Single frequency signal unit is designed to provide a means of converting direct current supervision signals to 2600 Hz Tone signals for transmission over 4-wire facilities and to convert incoming 2600 Hz tone to direct current signals. It is designed to function with circuits arranged for "E" and "M" lead signaling.

6.02 This circuit consists of a means of connecting and removing an external signal frequency tone source to the transmit leg of the transmission path. It is also a signal receiver to filter and detect a 2600 Hz signal on the receive leg while rejecting normal voice or data signals.

6.03 The signal receiver consists of a high impedance bridging transformer, a filter network, an amplifier, limiter, detector filter, detector, transistor switch, relay and time delay network.

6.04 The simplicity of the circuit is due to the slow operate time of the output relay. A time delay of approximately 350 milliseconds is introduced to prevent false operations due to short interval voice peaks or data signals entering the detector circuit. This circuit CANNOT be used in applications that require the transmission of pulses.

### 7. POWER RINGING AND TONE CIRCUIT

7.01 The tone supply, ringing supply and rectifier for the 400 Data Package are all powered from 105 to 129 volts commercial AC power.

7.02 Ringing is 30 Hz with superimposed DC tripping battery. Options are available to provide continuous ringing, or the equivalent of machine ringing.

7.03 Two oscillators powered from -48 volts generate frequencies 2025 and 2225 Hz and are used by the associated retry circuit to release a station when the call can not be completed in the allotted time.

7.04 Permanent signal (PS) tone is a 2600 Hz tone supplied from from 2600 Hz Tone Distribution circuit.