ENERGY COMMUNICATION SIGNALING UNIT

DESCRIPTION

"DIMENSION®" PBX

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Tables

1. GENERAL

1.01 This section provides descriptive information, the interface specifications, theory of operation, and installation and maintenance information for the energy communication signaling unit (ECSU) (Fig. 1).

1.02 The reasons for reissuing this section are listed below. Revision arrows are used to emphasize the more significant changes.

(a) To update the power input to ECSU

(b) To correct information on transformer KS-21239, L6

(c) To provide current ECSU information.

1.03 This section is based on the drawings listed in Part 6. If this section is to be used with equipment or apparatus reflecting later issue(s) of the

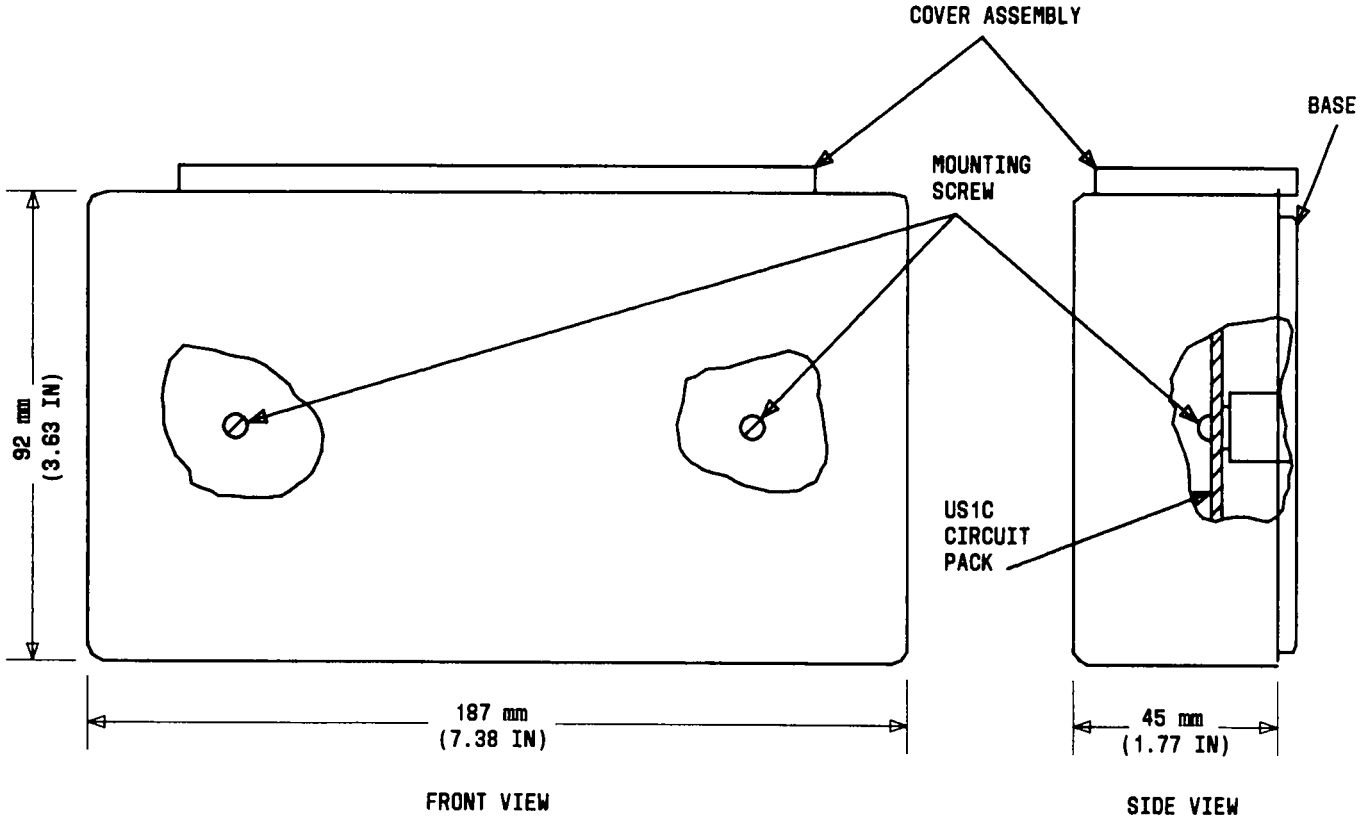


Fig. 1—Energy Communication Signaling Unit

drawing(s), reference should be made to the schematic diagrams (SDs) and circuit descriptions (CDs) to determine the extent of the changes and the manner in which the section may be affected.

2. DESCRIPTION

A. General

2.01 The ECSU is designed to be used with the DIMENSION 600 (formerly 400E), 2000, and Custom PBXs when configured with the Energy Communications Service feature of Feature Package 9 and Feature Package 11.

2.02 The ECSU provides an interface between customer-provided equipment and the DIMENSION PBX. Function of the ECSU is to enable or disable energy consuming loads that are located remotely from the PBX, usually within the hotel/motel facility; however, the controlled energy consuming load could be located off-premise. Each ECSU is connected directly to the tip and ring leads of a DIMENSION PBX telephone line. There are two classifications of consuming loads: guest room loads and individual loads. Guest room loads which are controlled by an ECSU must share the telephone line with the room telephone. Individual loads may be optioned for shared or dedicated operation to the telephone line (Fig. 2). One ECSU is required for each appliance or group of appliances to be controlled as a single entity. Some examples of energy consuming equipment that may be controlled are: heating, ventilating, air-conditioning equipment, indoor and outdoor lighting, electric signs, etc. Figure 3 shows one of several optional arrangements depicting how the ECSU may be connected to customer-provided equipment and to the PBX.

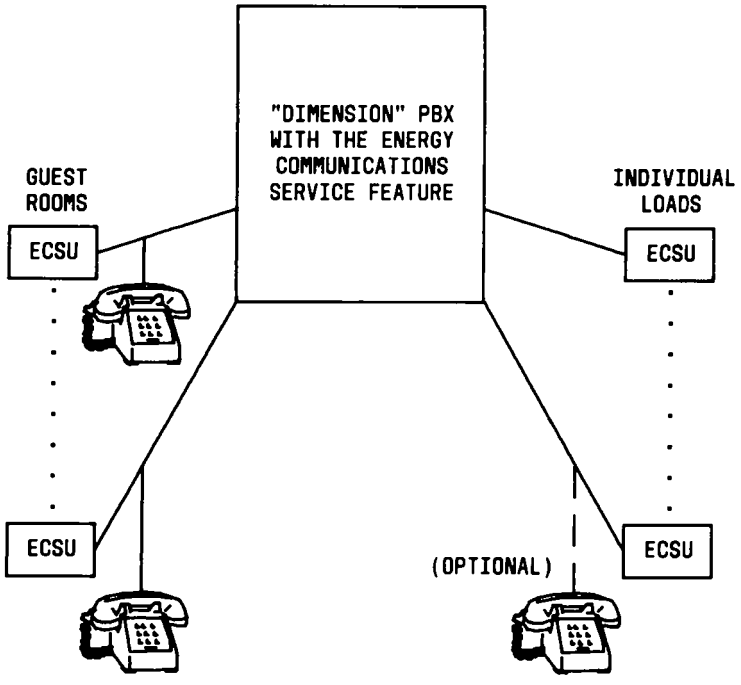


Fig. 2—Typical Connections for Dedicated and Shared ECSU Operation

2.03 The PBX provides the energy communication function by sending a tone (control signal) via the tip and ring pair to each ECSU. When the control signal is received, the respective ECSU disables or switches the load to a lower energy consuming state.

B. Physical Description

2.04 The ECSU consists of a 168-mm by 83-mm (6.7- by 3.3-inch) printed circuit board, terminal strip, mounting bracket, and plastic housing (Fig. 4). The plastic housing shown in Fig. 1 comes standard in black; however, the housing may be ordered in a variety of colors. Each ECSU may be mounted in only one position due to the use of internal mercury-wetted relays. It is designed to be wall-mounted with cable access from the top. The interconnecting cable is terminated on a terminal strip which is accessible from the front of the unit when the cover is removed. The ECSU contains no hazardous voltages and will be accessed only by operating company personnel.

2.05 An alternate housing is available for use when electrical codes and environmental constraints require that the wiring to the ECSU be enclosed in conduit. This housing consists of a metal box with knockouts for conduit connections and a mounting bracket for the circuit board.

2.06 The power required to drive the ECSU can be provided by either of two options. The first option uses a separate power transformer (KS-21239, L6) which is provided by the telephone company. The transformer is located at a customer-provided ac receptacle. A tab is provided on the transformer to securely fasten it to the power receptacle by means of the machine screw which attaches the cover plate of the receptacle. The power transformer plugs directly into a 120-volt 60-Hz source and supplies a nominal ▶13◀ volts with an output current of 400 milliamperes.

2.07 The second option is for the customer to furnish the power transformer. A separate transformer may be used or an isolated secondary winding of a transformer utilized for other purposes. The power transformer must meet or exceed all of the above requirements.

2.08 Relay contacts are described as operating in the "dry mode" when they switch power, which is supplied externally by the customer control circuit. The terminology "wet mode" applies to relay contacts that supply the driving power to the low-voltage, low-current control circuit. The transformer connects to the 12.5-Vac pins on the 9-pin terminal block (Fig. 5). Each ECSU requires approximately 100 milliamperes from the power transformer.

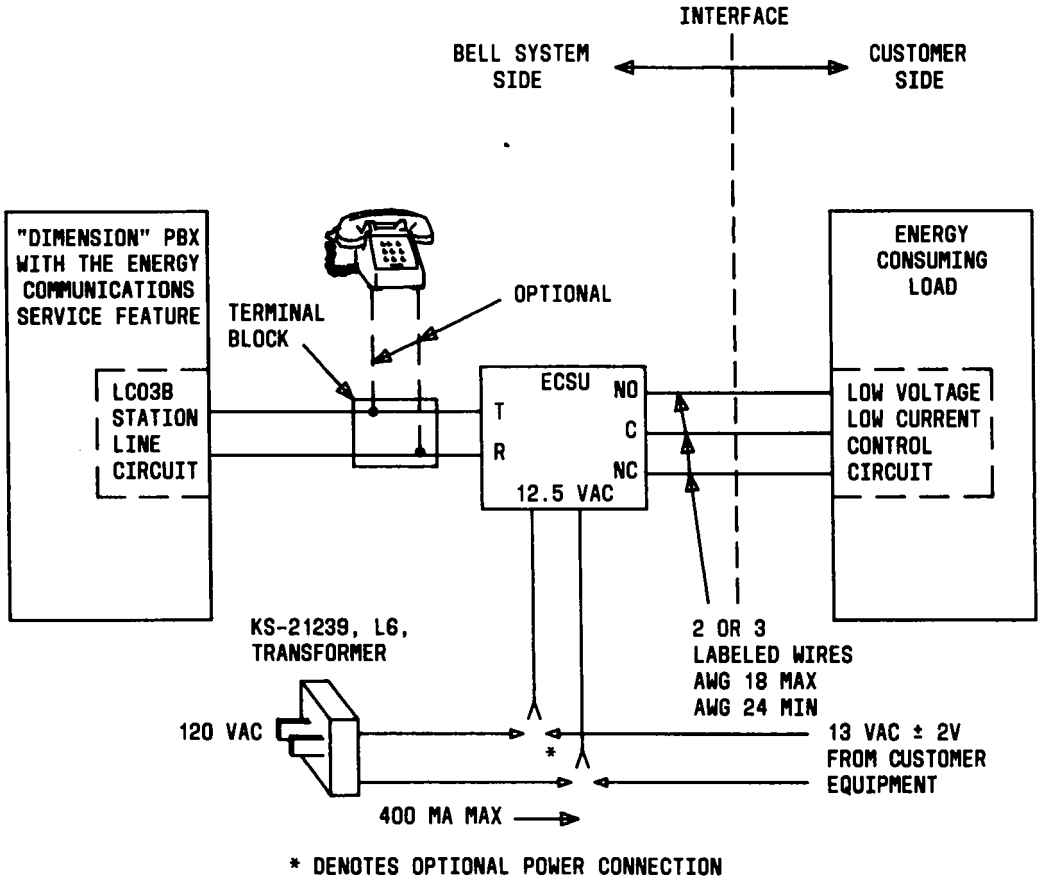


Fig. 3 — Typical Hardware Configuration and Equipment Interfaces

2.09 The ECSU provides a set of low-voltage, low-current relay transfer contacts which may be connected for either "dry" (standard) or "wet" (with the "wet" option strap) operation. The relay provides a set of transfer contacts so that a contact closure can be obtained in either the normally open (NO) or normally closed (NC) state of the relay. Each terminal block number, its associated label, and a brief description of the terminal function is shown in Table A.

Frequently, documentation discussing relay states use the terminology normally closed (NC) and BREAK contact interchangeably; also, the terminology normally open (NO) and MAKE contact are used interchangeably.

2.10 Maximum rating of the ECSU relay contacts are 2.0 amperes and 24 volts (48 voltamperes). The ECSU relay contacts are equipped with universal contact protection for either ac or dc voltages up to the maximum rating (24 volts). The relay contacts may be used in either single-pole double-throw (SPDT) or single-pole single-throw (SPST) action. Customer-provided equipment may connect to the terminal strip in any of six options. These options are summarized in Table B.

2.11 When the "dry" contact mode is used, the power to drive the customer's relay coil in the control circuit must be furnished by the customer. The power source can be either ac or dc.

C. Operating Limits

2.12 The ECSU operation is restricted in both environmental and electrical limits. These limits are listed as follows:

(a) The transformer primary input voltage must be between 100 and 130 volts rms when the KS-21239, L6, transformer is used.

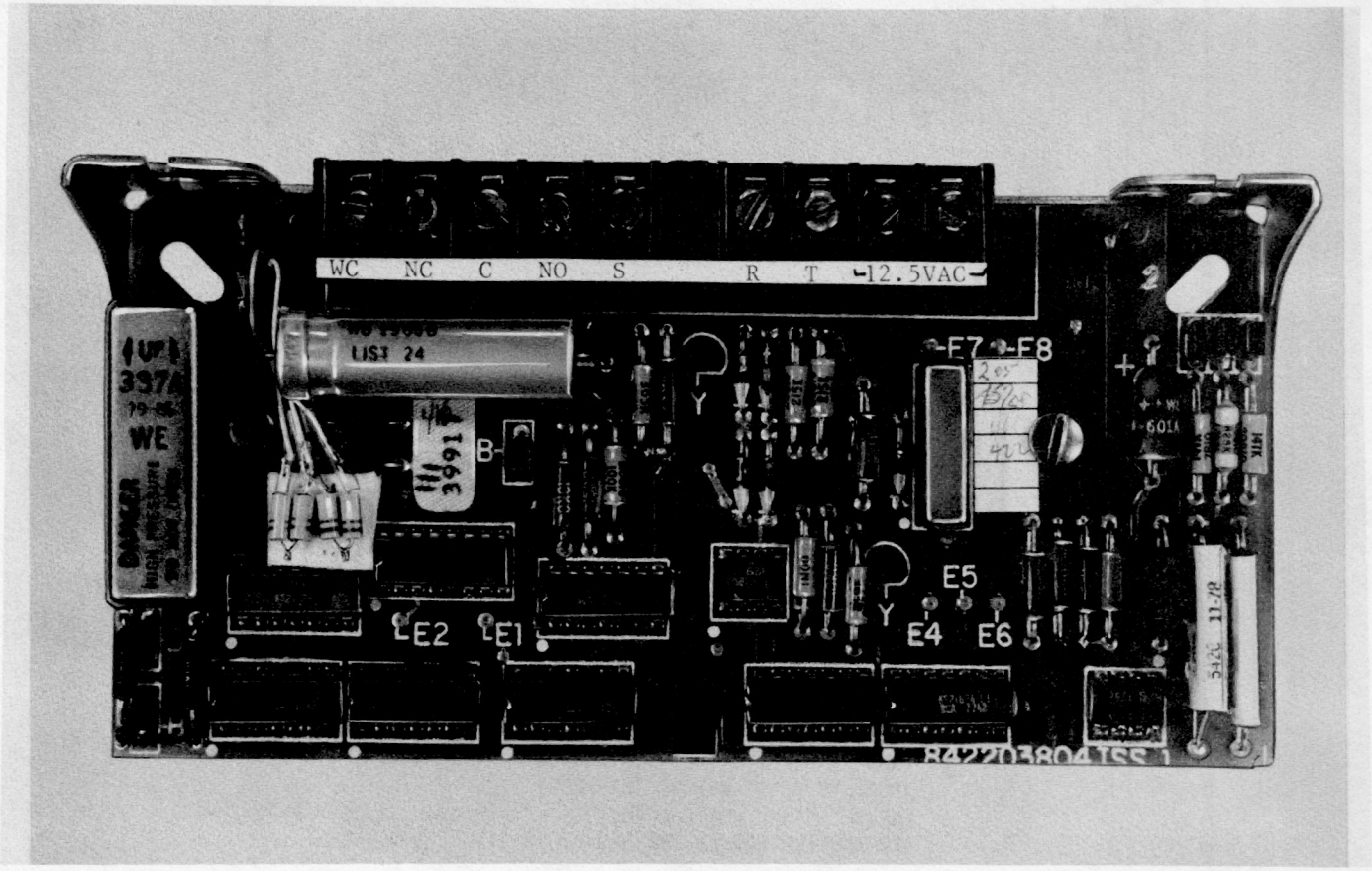


Fig. 4 — US1C Circuit Pack

(b) Input voltage, when measured at the 12.5-Vac terminals of the ECSU, must be from a minimum of 11.0 Vac to a maximum of 15 Vac at 100 milliamperes.

(c) The frequency of the power source should be a nominal 60 Hz with limits of 57 Hz and 63 Hz.

(d) The ECSU is designed to operate within a room temperature range of 0° to 49° C (32° to 120° F).

(e) The relative humidity must be greater than 10 percent, but less than 95 percent.

3. INTERFACE SPECIFICATIONS AND OPERATIONS

3.01 The interface specifications provide the electrical signal connections, signal levels in terms of magnitude, and hardware/software signal timing sequences required for the ECSU.

A. Operating Parameters

3.02 Voltage delivered to the ECSU must be 13 ± 2 volts rms at a nominal frequency of 60 Hz. The transformer winding supplying power to the ECSU must be insulated from ground with a breakdown voltage of at least 1500 volts rms. No other equipment can be connected to the transformer secondary winding used to supply power to the ECSU, except the power relay coil in the customer control circuit, which receives power from the ECSU ("wet" mode). If the power relay coil is driven by the transformer winding used to power the ECSU, either by the "wet" contact option or by the "dry" (external) connection, the power relay coil must be insulated from ground with a minimum breakdown voltage of 1500 volts rms. If the power transformer is not designed to withstand a short circuit across the secondary winding, it must be properly fused.

3.03 The transformer connects to pins 1 and 2 on the 9-pin terminal block. Each ECSU requires approximately 100 milliamperes from the power transformer.

3.04 The ECSU connects to the tip and ring leads from an LC03B line circuit pack. Operation of the ECSU does not interfere with normal telephone

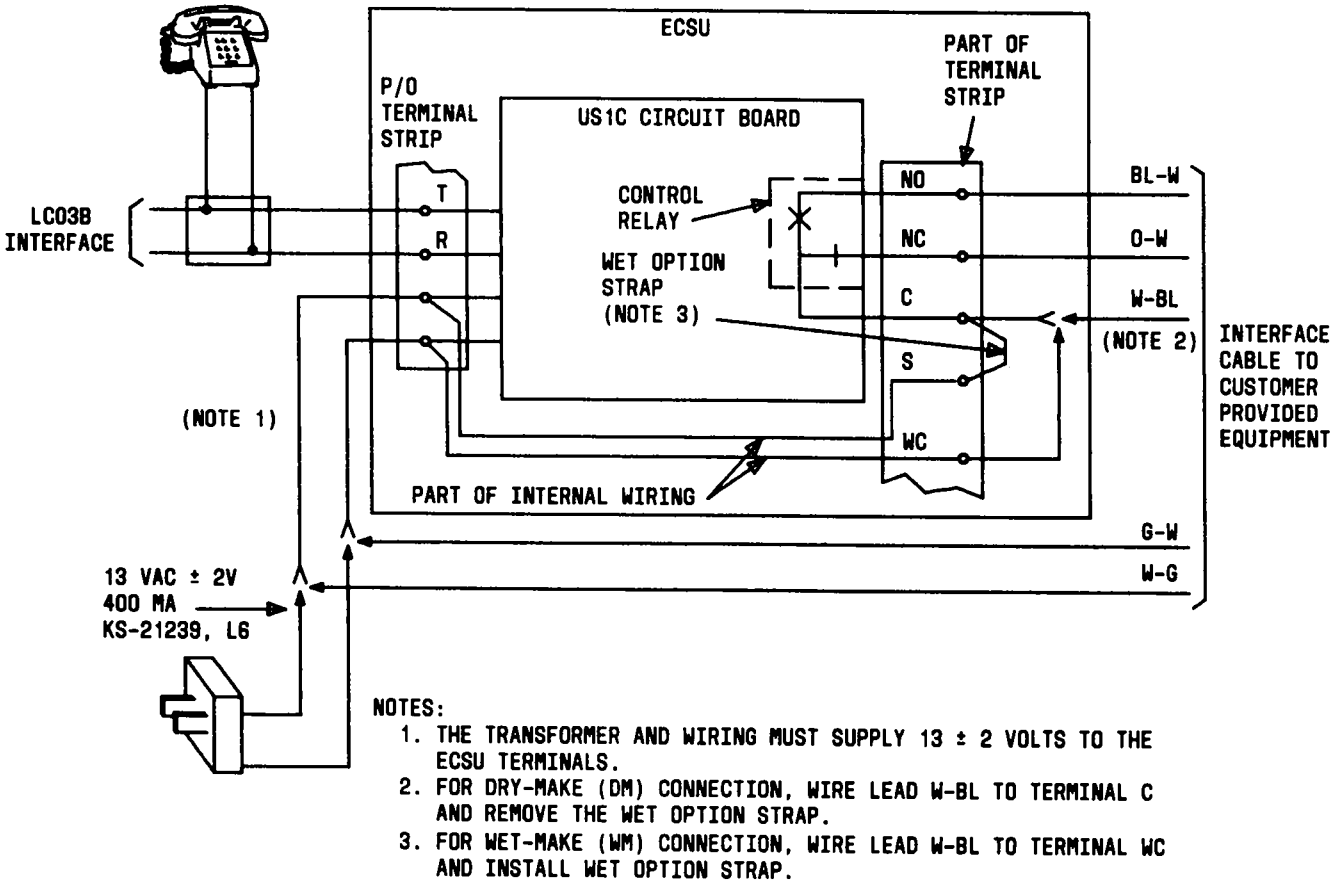
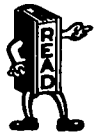


Fig. 5 — ECSU Wiring Connections

operation and may be connected in parallel with a telephone set (shared operation), or the ECSU may be dedicated to a telephone line. An extension number must be assigned to the line whether it is used for shared operation or dedicated to the ECSU. The recommended class of service for dedicated lines serving individual loads should be termination-restricted to prevent misdialed calls from interrupting control of the load. The Call Waiting feature cannot be used on a telephone which shares a line with an ECSU while the ECSU is activated.

B. Functional Operation



Signal designations shown with an asterisk (ONHK* for example) indicate that the normal logic level is high (1) and the primary functions of the lead are performed in the low (0) logic state. Lead designations without an asterisk (INSTS) indicate that the logic level is normally low (0) and the primary functions of the lead are performed in the high (1) logic state.

3.05 A functional block diagram of the ECSU control circuit pack (US1C) is shown in Fig. 6. Signal inputs to the ECSU consist of 440-Hz tone and status of the telephone switchhook. The PBX generates the 440-Hz miscellaneous tone as the signal for the connected ECSU to disable the associated energy consuming load. Magnitude of the 440-Hz may be from a minimum level of −17.9 dBm to a maximum of −10.2 dBm when measured at the ECSU.

3.06 The tone detector is bridged across the tip and ring and when a 440-Hz tone is detected, signal TN* is generated (Fig. 6). The switchhook status detector is also bridged across the tip and ring and when a telephone, sharing the same tip and ring, is on-hook, signal ONHK* is generated.

▶TABLE A◀

ECSU TERMINAL TABLE AND FUNCTION

TERMINAL NUMBER	TERMINAL LABEL	TERMINAL FUNCTION
1, 2	12.5 Vac	Terminals connect to the 13-volt transformer winding.
3*	T	Tip terminal of telephone line.
4	R	Ring terminal of telephone line.
5	S	Jumper strap terminal for "wet" contact.
6	NO	Normally open contact.
7	C	Common connection when the "dry" contact option is used.
8	NC	Normally closed contact.
9	WC	Common connection when the "wet" contact option is used.

*The T & R leads are interchangeable, polarity is independent.

TABLE B

RELAY CONTACT OPTIONS

CONTACT MODE	CONTACT ARRANGEMENT	CONTACT TERMINALS	"WET" OPTION STRAP
"Dry"	SPST normally closed	C, NC	Removed
"Dry"	SPST normally open	C, NO	Removed
"Dry"	SPDT transfer	C, NO, NC	Removed
"Wet"	SPST normally closed	WC, NC	C, S
"Wet"	SPST normally open	WC, NO	C, S
"Wet"	SPDT transfer	WC, NO, NC	C, S

3.07 Functions of the dc power supply are to rectify and filter the ac input voltage. Approximately 100 mA are required per ▶US1C◀ circuit pack and a maximum of 300 mA may be used by the customer control circuit ("wet" mode with KS-21239, L6, transformer). In addition, the clock signal (CLK*) is generated by the power supply.

3.08 The function of the timing circuit is to generate a timed output signal (INSTS) based on the input signals (CLK* and TRS). Signal INSTS normally alternates logic states on a 2-second timing interval. The 2-second time delay keeps noise bursts and quick ON/OFF switchhook transitions from causing the state of the relay to change. Signal TRS

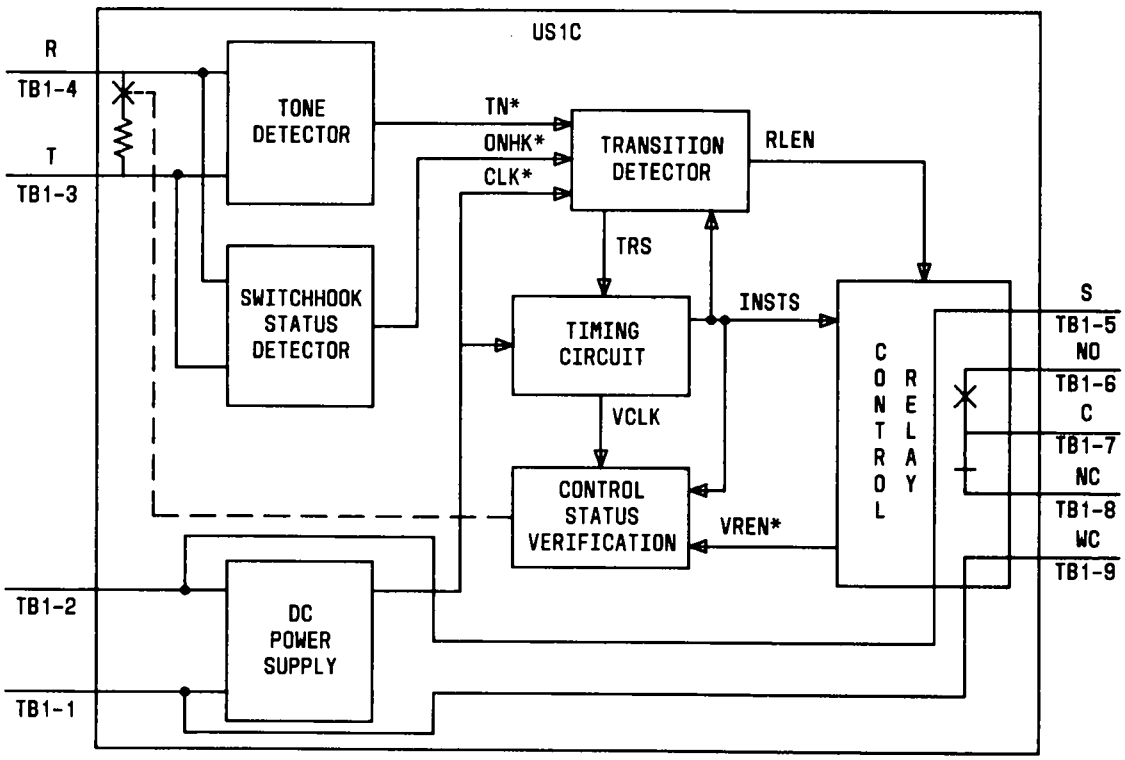


Fig. 6 — ECSU Functional Diagram

resets the timing circuit following a transition state change and signal INSTS remains at a logic low for 2.28 minutes, thus, inhibiting relay changes for the 2.28-minute time interval. The function of the 2.28-minute transition timer is to keep rapid relay changes from occuring, preventing damage to certain energy consuming loads that can be harmed by rapid ON/OFF transitions.

3.09 The transition detector functions to control state changes in the control relay. The transition detector receives as inputs TN*, ONHK*, CLK*, and INSTS. Signals TN* and ONHK* are logically "ANDed" in the transition timer to generate the relay enable signal (RLEN) and time-delayed signal TRS, provided that the 2.28-minute and 2-second timing constraints have been satisfied. The relay enable signal (RLEN) is strobed into the control relay circuitry by signal INSTS and causes the relay to be energized and the load to be disabled.

3.10 When the energy consuming load is disabled and the tone is then removed or, if the telephone goes off-hook, the "NC" contacts will be closed and the load will be enabled. If the "NC" contacts of the ECSU control relay are closed, the load can be turned on or off by the contacts in the customer-provided control circuit. The energy consuming load may or may not be on, depending upon conditions existing in the customer-provided control circuit.

C. Fail-Safe Operation

3.11 The ECSU relay provides for fail-safe operation if properly connected. That is, if the 440-Hz tone fails to reach the ECSU or, if the power fails in the ECSU, the energy consuming load can still be controlled by the customer-provided control circuit. In addition to power failure in the ECSU, nearly all conceivable failure modes for the unit result in fail-safe operation. When power is restored to the ECSU after a power failure, the ECSU will be set to the fail-safe mode (relay not energized) for a minimum of 2 seconds to a maximum of 2.28 minutes. Following the initialization period, the relay can be controlled by the presence or absence of the 440 Hz tone. If short power failures (usually less than 50 milliseconds) occur when the ECSU relay is not energized, it will remain in that state. If a short power

failure occurs when the relay is energized, it may revert to the nonenergized state for a period of time lasting from a few milliseconds to a maximum of 2.28 minutes.

D. Control Status Verification

3.12 The state of the ECSU relay may be determined by the on-line software or by the off-line maintenance software (Maintenance and Administration Panel [MAAP] Procedure PROC 534) of the PBX. The actual relay state is determined by the PBX sending timed ON/OFF sequences of 440-Hz tone and monitoring the ECSU response which is in the form of a timed off-hook.

3.13 When the control is enabled, it generates the verification relay enable (VREN*) signal. Signals VREN* and VCLK are inputs to the control status verification circuit. These signals are used during a PBX query to generate the relay closure on the tip and ring pair which is the off-hook stimulus. The type of query sent to the ECSU and the correct response are a function of the state of the relay. The current relay state is recorded in the PBX status memory. The query response for an active relay with the energy restriction feature enabled (tone present and current in the relay coil) consists of:

(1) Tone removed for a period of 1.04 seconds (minimum) to 2.11 seconds (maximum).

(2) Tone applied for a period of 1.04 seconds (minimum) to 2.11 seconds (maximum).

(3) Tone removed for a period of 1.04 seconds (minimum) to 2.11 seconds (maximum).

The ECSU generates an off-hook stimulus lasting from a minimum of 484 ms to a maximum of 516 ms as the response, indicating that the relay is in the controlled state (active state).

3.14 The query-response for an inactive relay consists of:

(1) Tone applied for a period of 1.04 seconds (minimum) to 2.11 seconds (maximum).

(2) Tone removed for a period of 1.04 seconds (minimum) to 2.11 seconds (maximum).

(3) Tone applied for a period of 1.04 seconds (minimum) to 2.11 seconds (maximum).

The ECSU generates an off-hook stimulus lasting from a minimum of 108 ms to a maximum of 125 ms. The 2.11 seconds maximum of tone applied or tone removed during the query sequence prevents any actual relay state changes in the ECSU.

4. INSTALLATION

4.01 The telephone company shall be responsible for the installation and maintenance of the ECSU including ***all connections*** directly to the terminals of the ECSU and to the PBX. The ECSU should be installed as close as possible to the customer equipment; preferably within 1524 mm (5 feet). All wiring to and from the ECSU must conform to both national and local electrical codes. In the majority of cases where ECSUs are utilized, those loads which are to be restricted will be of the individual type. The type housing cover selected for the ECSU (plastic or metallic) will normally be of the plastic type and of the customer's color selection, unless the customer and/or electrical codes require usage of the metallic housing.

4.02 A customer floor plan should be prepared by the customer service representative, indicating the location of each ECSU and customer power relay. Additionally, the floor plan indicates the wiring contact arrangement required for each ECSU. A copy of this document should be retained at the energy console. A stick-on label (Fig. 7), to be attached to the inside of the ECSU cover, will be provided to record the individual options and terminations of each ECSU. The label is designed to facilitate maintenance in those cases when the interconnecting cable must be disconnected. The ECSU will be identified by a station designation.

4.03 The ECSU may be mounted in only one orientation due to the use of internal mercury-wetted relays. It is designed to be wall-mounted with cable access from the top. The interconnecting cable is terminated on internal screw terminals which are accessible from the front of the unit when the cover is removed. The ECSU contains no hazardous voltages and can be accessed only by operating company personnel.

4.04 The operating company installer will provide and place a 3-pair color-coded inside wiring cable preferably less than 1524 mm (5 feet) between the ECSU and the location of the customer-provided equipment associated with that ECSU. Two to five wires will be interconnected, as required, for the specific application. The BL-W/W-BL and O-W/W-O

CIRCLE CORRECT OPTION REQUIRED BY CUSTOMER

ECSU TERM	COLOR CODE	DRY MAKE	DRY BREAK	SET MAKE	SET BREAK	DRY MAKE BREAK	WET MAKE BREAK
NO	BL-W	X		X		X	X
NC	O-W		X		X	X	X
C	W-BL	X	X	X STRAP	X STRAP	X	X STRAP
S				X	X		X
WC	W-BL			X	X		X

- USE 3 PR INSIDE WIRING CABLE FROM ECSU TO CUSTOMER AND TAG.

- TERMINATE LINE FROM PBX ON T & R.
- POWER TO ECSU TERMINATED ON 12.5V TERMINAL CAN BE SUPPLIED BY TELCO USING KS-21239, L6, TRANS OR FROM CUSTOMER USING GW/WG PR IN 3 PAIR INSIDE WIRING CABLE.

Fig. 7—Designation Label

pairs are used to connect to the ECSU contacts as specified by the customer and the G-W/W-G pair is used when the customer provides the ◗13-volt◖ power source to the ECSU. The installer will terminate the cable on the ECSU and attach labels to the customer end (ie, label the BL-W wire NO). If ECSU power (◗13◖ Vac) is to be provided by the customer, the installer shall not terminate the power leads on the ECSU until a voltmeter check is made to ensure that the correct voltage is present. A second voltmeter check is required after the ECSU is connected to determine that the voltage remains within the specified limits. Activities of the installer and customer electrician must be closely coordinated.

4.05 The telephone company installer shall connect the ◗13-Vac◖ power leads to terminals 1 and 2 of the terminal block and the T and R pair to terminals 3 and 4. Five terminals and the "wet" option strap are provided for connection to the low-voltage, low-current control circuit. Wires used to connect to the ECSU relay terminals should be no larger than 18 AWG (maximum) and no smaller than 24 AWG (minimum). Table B lists six wiring options which are available for connection to customer-provided equipment. The easiest energy consuming load, to provide control, is one that already has a means of low-voltage control, which requires either the "dry" make or "dry" break contact arrangement (Fig. 8).

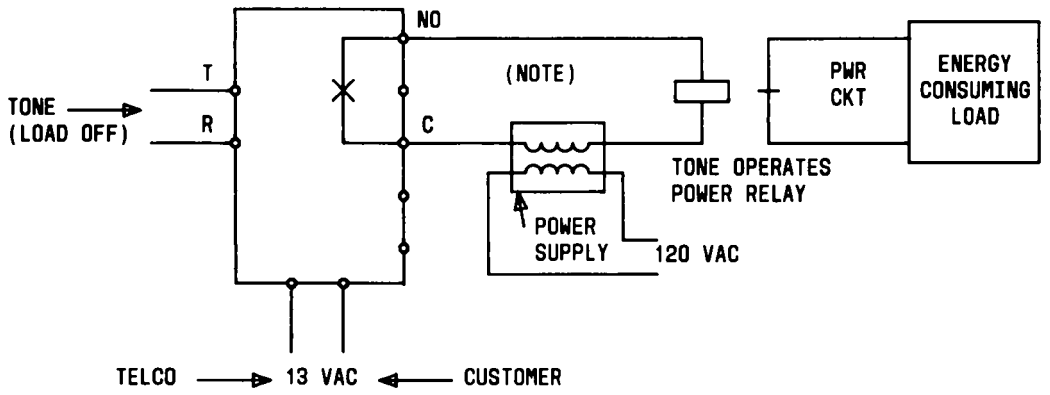
4.06 Energy consuming loads consisting of control circuits without a source of power may obtain power from the ECSU relay contacts (Fig. 9). Figure 10 shows a typical low-voltage, low-current control circuit utilizing the ECSU relay in the "wet" mode with SPDT transfer contacts frequently referred to as the "wet" break-make wiring connection.

4.07 Figure 11 shows the dual thermostat arrangement in which the ECSU provides restriction via the "dry" make-break wiring connection.

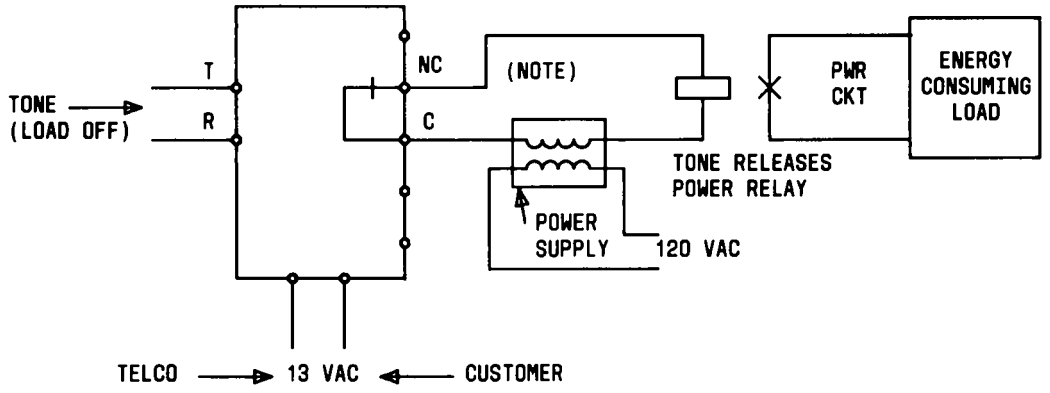
5. MAINTENANCE

5.01 Maintenance of the ECSU is limited to the following:

- Checking for correct operation of the LC03B line interface circuit
- Making continuity checks on the wiring between the LC03B and associated ECSU(s)
- Status verification of the ECSU
- Making voltage checks to determine if the ECSU is receiving power
- Making checks on the relay contacts to determine if voltage is present and within allowable ranges (ie, 12 Vac for "wet" mode and 6, 12, or 24 volts ac or dc), as required, by the customer-supplied power supply
- Making continuity checks on the wiring between the ECSU transfer contacts and the low-voltage, low-current control circuit.



A. DRY-MAKE ARRANGEMENT



B. DRY-BREAK ARRANGEMENT

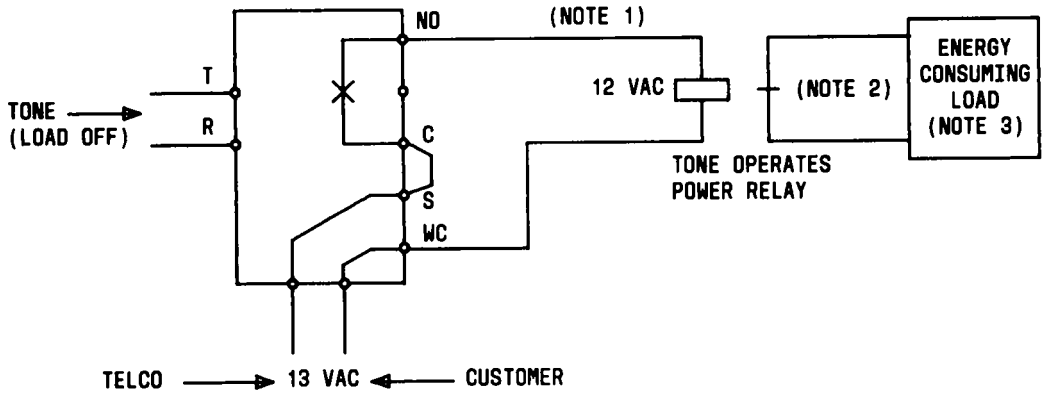
NOTE:
THE POWER SUPPLY MAY BE FROM 6 TO 24 VOLTS OF EITHER AC OR DC AS REQUIRED BY THE POWER RELAY. HOWEVER, THE RELAY COIL CANNOT REQUIRE MORE THAN 2 AMPERES BECAUSE OF RELAY CONTACT LIMITATIONS WITHIN THE ECSU.

Fig. 8 — ECSU "Dry" Wiring Connections

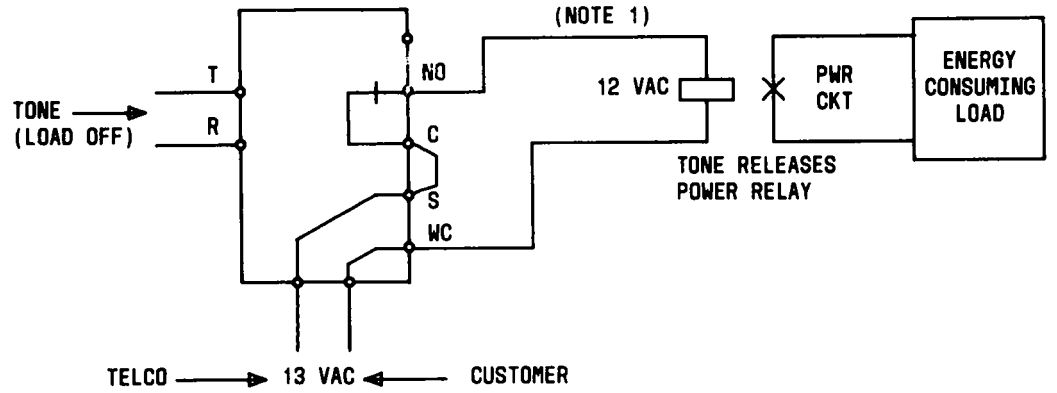
5.02 Most installations using ECSUs will normally have many units located at various remote locations. For troubleshooting purposes, it would be very time consuming to go to each remote location to periodically check the status of each control relay. Furthermore, the control unit may be installed in an area which is not readily accessible at the time the tests are to be made. The status of each ECSU control relay in the installation can be checked from the PBX by transmitting timed pulses of 440-Hz tone over the telephone line to each ECSU.

5.03 The ECSU being tested responds by sending a timed off-hook signal back to the PBX. The telephone which shares the line with the ECSU must be on-hook and the control relay in the ECSU must have been in its present state for more than 2.28 minutes before the status verification test can be made.

5.04 The MAAP Procedures PROC 534, PROC 550, and PROC 581 are used in checking the status of the ECSU and LCO3B. Refer to the appropriate



A. WET-MAKE ARRANGEMENT



B. WET-BREAK ARRANGEMENT

NOTE:
1. EXTERNAL RELAY COIL MUST BE OPERATED BY 12 VAC WITH A PULL IN CURRENT OF 300 MA (MAXIMUM) OR LESS. RELAY CONTACTS MUST BE OF SUFFICIENT CAPACITY TO SWITCH THE LOAD CURRENT.
2. CONTACT PROTECTION FOR THE CONTACTS OF THE EXTERNAL RELAY IS THE CUSTOMERS RESPONSIBILITY.
3. THE ENERGY CONSUMING LOAD MUST BE PROPERLY INTERFACED TO THE ECSU RELAY CONTACTS.

Fig. 9 — ECSU "Wet" Wiring Connections

TOP documents for detailed testing procedures to isolate trouble to a particular ECSU or associated PBX circuit.

5.05 The customer is expected to participate in the maintenance process as much as is practical. The customer is responsible for proper connection of the energy consuming load, its associated control circuits, and to the interconnecting wires provided by the telephone company. Each customer is also responsible for the operation and maintenance of all customer-owned equipment.

6. REFERENCES

6.01 The following sections are associated with the ECSU and, when available, may be used for additional information.

SECTION	TITLE
554-000-000	DIMENSION PBX—Numerical Index (Refer to Numerical Index for TOP Documents)

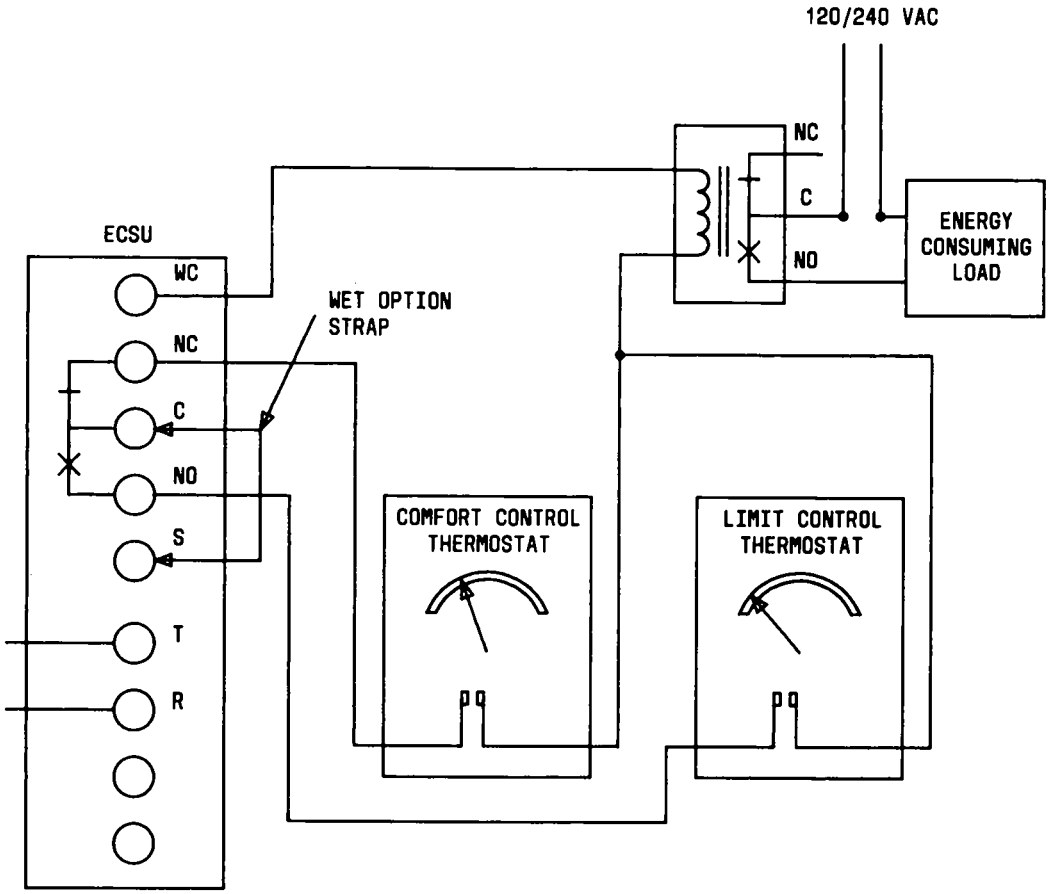


Fig. 10—"Wet" Break-Make Wiring Connections

SECTION	TITLE
554-105-101	DIMENSION ◗600◖ PBX—Preinstallation and Planning Information
554-111-101	DIMENSION 2000 and Custom PBX—Preinstallation and Planning Information
554-191-100	DIMENSION PBX—Feature Document Reference Guide

6.02 The following schematic diagrams (SDs) and associated circuit descriptions (CDs) are applicable and may be referred to when necessary.

SD-1E468-01, Issue ◗2A◖ — Energy Communications Signaling Unit

SD-1E464-01, Issue ◗12D◖ — DIMENSION 600 PBX

SD-1E480-01, Issue ◗52D◖ — System Circuit CSS201L

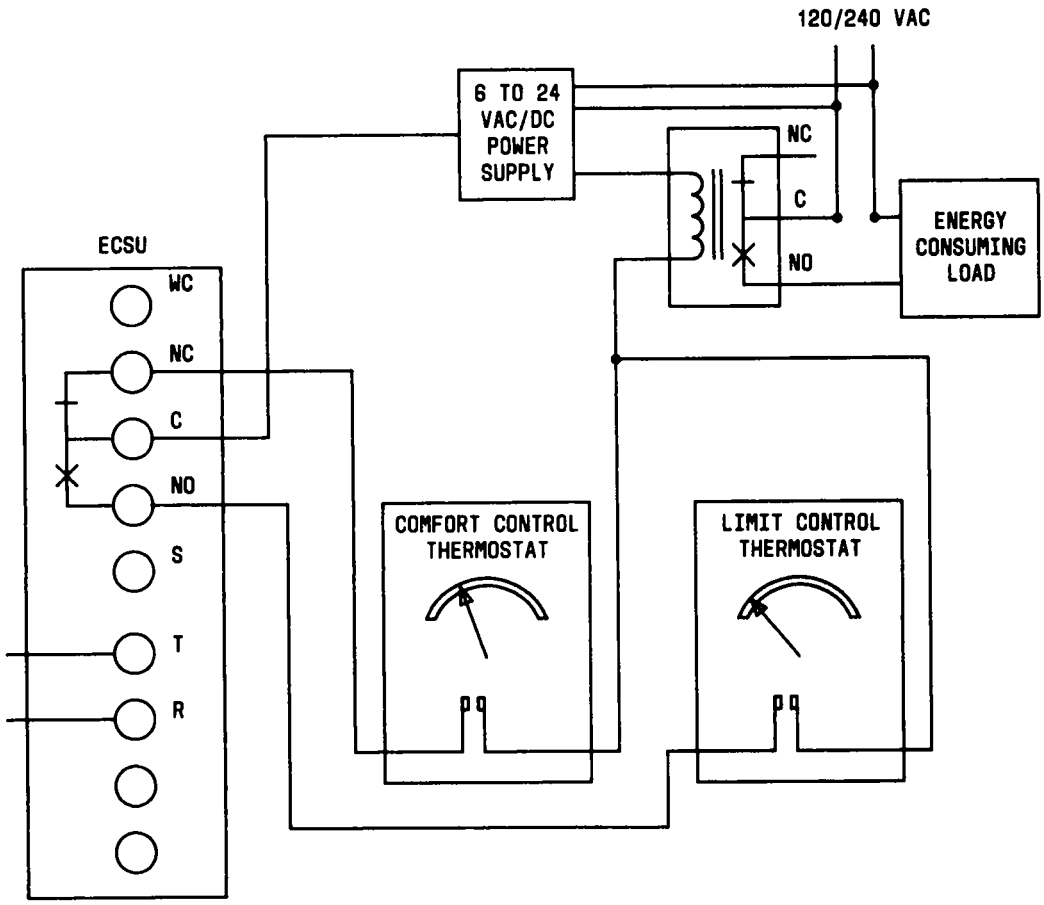


Fig. 11—"Dry" Make-Break Wiring Connections