# EQUIPMENT SPECIFICATION
# TRW-151 PAPER-TAPE READER AND REELER
# TRW-130 ELECTRONIC DATA PROCESSING SYSTEM
# 40015649

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THOMPSON RAMO WOOLDRIDGE INC.
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# EQUIPMENT SPECIFICATION
# TRW-151 PAPER-TAPE READER AND REELER

## 1. SCOPE

1.1 This specification covers one type of photoelectric tape reader and electromechanical reeler designated the TRW-151 Paper-Tape Reader and Reeler. The TRW-151 reads paper tape in response to data input and instruction signals from a TRW-140 Controller. Both equipments are part of the TRW-130 Data Processing System.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein.

### 2.1.1 SPECIFICATIONS

Thompson Ramo Wooldridge Inc., RW Division

| | |
|---|---|
| 400951 | Specification Control Drawing, Tape, Paper, Mylar Sandwich (Data Processing) |
| 40015646 | Equipment Specification, TRW-140 Controller |

# 3. DESIGN AND PERFORMANCE

## 3.1 TAPE READER

### 3.1.1 TAPE CHARACTERISTICS

| | | |
|---|---|---|
| a. | Tape: | See RW Specification Control Drawing 400951 |
| b. | Tape Size: | 11/16", 13/16", 7/8", or 1" widths with 5, 6, 7, or 8 channels plus sprocket, all read interchangeably with minor adjustments to the tape guide system. |
| c. | Tape Travel: | Unidirectional from right to left. |
| d. | Reading Speed: | 400 characters per second in the Block Read Mode. |
| e. | Start Time: | 3 milliseconds (nominal) |
| f. | Stop Time: | Less than 1 millisecond (maximum) on command signal |
| g. | Tape Loading: | True in-line loading without cumbersome manipulations. |

3.1.2 CONTROLS. - The controls governing operation of the Paper Tape Reader and Reeler are located on the TRW-140 Controller.

3.1.2.1 START-STOP SIGNAL. - The start-stop signal is -10 volts at 0.2 ma. The tape reader operates when the signal is applied and stops when the signal is removed.

3.1.3 TERMINALS. - Terminals are provided on a connector at the rear for the electrical mode of operation.

3.1.4 ELECTRONICS. - Silicon photoconductive diodes are provided in an internally mounted plug-in assembly for up to 8 channels plus the sprocket. Electronic circuits are provided to detect and

## 3. DESIGN AND PERFORMANCE (Cont'd)

amplify all channels for outputting to the TRW-140 Controller. All circuitry in the unit is solid state.

a. Input:

1. Power Requirements: 118 volts ±10%, 60 cps ±10%, 130 watts; and -13.5 volts, not to exceed 200 ma.

b. Output: Nine signal outputs (a sprocket channel and eight data channels).

1. Data Channels:

(a) Output voltage for no hole response with a 1-kilohm resistor connected to -13.5 V: 0 ±1 volt d-c

(b) Output voltage for hole response with 7.5-kilohm resistor connected to ground: -10 volts d-c

2. Sprocket Channel:

(a) Output voltage for no hole response with a 1-kilohm resistor connected to -13.5 V: 0 ±1 volt d-c

(b) Output voltage for hole response with 7.5-kilohm resistor connected to ground: -10 volts d-c

3. Pulse Width: 0.3 ms ±0.1 ms

4. Rise and Fall Times: Not greater than 2 and 5 microseconds respectively, measured between the 10% and 90% points.

5. A 115-volt, 60-cps, 250-watt convenience power outlet is provided for the tape reeler.

## 3. DESIGN AND PERFORMANCE (Cont'd)

### 3.1.5 PHYSICAL CHARACTERISTICS

| | |
|---|---|
| a. Dimensions: | The unit is compactly packaged. The front panel height is 5-1/4 inches and designed for standard 19-inch rack mounting. Dimensions behind panel: 12" deep, 17-1/2" wide; front panel extension: 1-3/8"; panel thickness: 1/4". No limitation on attitude. |
| b. Cooling: | The reader operates in a free convection, ambient temperature up to 40°C. If it is mounted close to heat generating equipment, localized hot spots may result and forced cooling may be required. |

3.2 TAPE REELER. - The Tape Reeler is a unidirectional tape handler. The drive system prevents tape spillage or damage, and rapid reel changing is accomplished by a quick release reel assembly without sacrifice of positive holding features.

### 3.2.1 TAPE CHARACTERISTICS

| | |
|---|---|
| a. Tape Speed: | Any speed up to 40 ips bidirectional under complete reader control in all operational modes. |
| b. Rewind Speed: | Separate rewind switch for manual control at 40 ips average tape speed. |
| c. Reel Size: | 5" to 8" diameter reels. |

3.2.2 CONTROLS. - Tape reeler is slaved to reader through tension arm control, maintaining constant tape tension independent of reader operational mode.

3.2.3 POWER. - 118 volts $\pm$10%, 60 cps $\pm$10%, single phase.

3. DESIGN AND PERFORMANCE (Cont'd)

3.2.4 PHYSICAL CHARACTERISTICS

a. Dimensions: Standard relay rack, mounting, 19" wide x 10-7/16" high x 12" maximum, with approximate 2-1/2" front panel extension.

3.3 WEIGHT. - The weight of the Paper Tape Reader and Reeler does not exceed 75 pounds.

3.4 INSTALLATION CRITERIA. - The reeler must be mounted directly below and in the same vertical plane as the tape reader in order to properly feed and receive tape from the reader. This mounting arrangement is normally provided in the TRW-140 Controller.

3.5 INTERFACE DESCRIPTION. - Circuits providing interface between the TRW-151 and the TRW-130 Computer are in the TRW-140 Controller. System interface is established by plug-in connection of the TRW-151 to the TRW-140. (See NOTES, 6.1.)

3.6 SUPPORT DATA. - Two copies of each of the following are supplied with each TRW-151 Reader and Reeler:

a. Operation Instructions
b. Maintenance Instructions
c. Schematics
d. List of Parts (name and part number)
e. List of Special Tools (name and part number)

NOTE: Operation and maintenance instructions and schematics are provided in the TRW-140 Controller manual.

3. DESIGN AND PERFORMANCE (Cont'd)

3.7 SAFETY. - The design incorporates methods to protect operating and servicing personnel from accidental contact with electric potentials in excess of 70 volts rms, and does not embody mechanical features which may reasonably be expected to cause injury during normal operation or because of malfunctioning of equipment.

3.8 IDENTIFICATION. - Each TRW-151 Tape Reader and Reeler is identified by a nameplate containing the applicable manufacturer's drawing number, serial number, name of the equipment, model number and specification number.

3.9 WORKMANSHIP. - The methods and techniques of workmanship used in the fabrication and assembly of parts, subassemblies, and assemblies are consistent with the recognized and accepted standards for high-grade quality manufacturing of electromechanical equipment, and are in accord with the current state-of-the-art practices.

4. QUALITY ASSURANCE PROVISIONS

4.1 GENERAL. - Inspections and tests are performed on each Paper Tape Reader and Reeler to determine compliance with the requirements of this specification. Records with validated results of the inspections and tests are kept complete and available to the customer.

4.2 CLASSIFICATION OF TESTS. - Tests consist of:

a. Inspection Tests.
b. Performance Tests.
c. Acceptance Tests.

4.3 TEST CONDITIONS. - All tests are conducted with the equipment subjected to ambient atmospheric conditions as encountered within the test facility.

## 4. QUALITY ASSURANCE PROVISIONS (Cont'd)

### 4.4 INSPECTION TESTS

4.4.1 MECHANICAL TESTS. - Each Paper Tape Reader and Reeler equipment is given a thorough mechanical and visual inspection to verify conformance to the physical requirements of this specification. Particular attention is given to the following:

a. Identification markings.

b. Ease of operation of keys, switches, and other controls.

c. Proper operation of tape or paper threading spools and reels.

d. Quality of workmanship on parts, materials, and finishes.

4.4.2 ELECTRICAL TESTS. - Each Paper Tape Reader and Reeler is given all the electrical tests necessary to verify that the electrical circuits are properly wired, exhibit continuity, and conform to the specified requirements.

4.5 PERFORMANCE TESTS. - Each Paper Tape Reader and Reeler is given all performance tests necessary to verify conformance with the applicable requirements of this specification.

4.6 ACCEPTANCE TESTS. - Acceptance tests are performed by RW Division to verify compliance with the applicable portions of this specification.

## 5. PREPARATION FOR DELIVERY

5.1 Each Paper Tape Reader and Reeler is packed in a manner that will insure acceptance by domestic common carrier and safe delivery at destination. Shipping containers will comply with the Consolidated Freight Classification rules, or regulations of other carriers as applicable to the mode of transportation.

## 6. NOTES

6.1 When the TRW-151 Paper Tape Reader and Reeler is purchased after delivery of a TRW-140 Controller, the following additional insert circuit card will be required.

| | | |
|---|---|---|
| 1 Each | Logic Transfer | RW Part No. 40015171 |

EQUIPMENT SPECIFICATION

TRW-161 PAPER-TAPE PUNCH UNIT

TRW-130 ELECTRONIC DATA PROCESSING SYSTEM

40015648

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THOMPSON RAMO WOOLDRIDGE INC.

RW DIVISION

CANOGA PARK, CALIFORNIA

# EQUIPMENT SPECIFICATION
# TRW-161 PAPER-TAPE PUNCH UNIT

## 1. SCOPE

1.1 This specification covers one type of punch device, designated the TRW-161 Paper-Tape Punch Unit, intended to perforate paper tape in response to instructions from a TRW-140 Controller. The TRW-161 Paper-Tape Punch Unit and the TRW-140 Controller operate in conjunction with a TRW-130 Digital Computer as part of the TRW-130 Electronic Data Processing System.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein.

Thompson Ramo Wooldridge Inc., RW Division

40015646 Equipment Specification, TRW-140 Controller

## 3. REQUIREMENTS

### 3.1 DESIGN AND PERFORMANCE

3.1.1 GENERAL DESCRIPTION. - The TRW-161 Paper-Tape Punch is a self-contained, high-speed unit designed to accept up to eight channels of paper tape of varying widths. The punch drive is non-synchronous, and its speed is limited only by the requirement that the minimum interval between cycles is 16.67 milliseconds. This enables the punch to be slaved to other equipment. Punching is controlled by the application of any combination of nine drive pulses (one drive pulse for each bit level, plus one drive pulse for sprocket and paper advance) at any rate up to 60 pps.

3. REQUIREMENTS (Cont'd)

3.1.2 CHARACTERISTICS

| | | |
|---|---|---|
| a. | Operating speed | Variable from 0 to 60 characters per second. |
| b. | Standard code channels | 5, 6, 7 or 8 levels. |
| c. | Code hole size | 0.072 inch diameter on standard 0.1 inch centers. |
| d. | Feed hole size | 0.047 inch diameter. |
| e. | Alignment | Code holes and feed holes have a common centerline. |
| f. | Standard tape widths | 0.687, 0.875 and 1.000 inch. |
| g. | Supply | 8-inch reel. |
| h. | Input pulse requirements, sprocket and paper drive clutches (in parallel) | 48 V (300 ma) into punch coil resistance of 160 ohms or 28 V (600 ma) into punch coil resistance of 47 ohms. Pulse duration: 4.5 ± 0.5 ms. |
| i. | Input pulse requirements, punch clutches | 48 V (160 ma) into punch coil resistance of 300 ohms or 28 V (320 ma) into punch coil resistance of 88 ohms. Pulse duration: 4.5 ± 0.5 ms. |
| j. | Drive motor | 1/50 hp, 110 V ac, 60 cps at 0.4 ampere. |
| k. | Feed drive hole punch | Electrically tripped, mechanically driven. Feed drive hole results in paper advance. |
| l. | Code hole punch | Electrically tripped, mechanically driven. |
| m. | Modular unitized construction | Assures ease of maintenance and accessibility. |
| n. | Service | Punch mechanism enclosed and oil-lubricated to insure long life and quiet operation. |

3.1.3 OPERATING ENVIRONMENT. - The Paper Tape Punch is designed for an operating environment as follows:

| | | |
|---|---|---|
| a. | Temperature: | $0^{\circ}C$ to $40^{\circ}C$ |
| b. | Relative Humidity: | 0% to 95% |

3. REQUIREMENTS (Contd)

3.1.4 INSTALLATION CRITERIA. - The Paper Tape Punch is normally factory-installed and requires no installation instructions. Mounting facilities for the unit are provided in the TRW-140 Controller cabinet. To remove the Paper Tape Punch from the cabinet, it is necessary only to remove the screws, cup washers, and spring washers securing the unit to the cabinet frame, then disconnect the internal cables and pull the unit out the front of the cabinet. To re-install the unit, the removal procedure is reversed.

3.1.5 INTERFACE REQUIREMENTS. - Circuits providing interface between the Paper-Tape Punch and the TRW-130 Digital Computer are in the TRW-140 Controller. System interface is accomplished by plug-in connection of the Paper-Tape Punch to the TRW-140 Controller. (See NOTES, 6.1.)

3.1.6 SUPPORT DATA. - Two copies of each of the following are supplied with each Paper-Tape Punch.

a. Operation Instructions
b. Maintenance Instructions
c. Schematics
d. List of Parts (name and part number)
e. List of Special Tools (name and part number)

NOTE: Operation and maintenance instructions and schematics are provided in the TRW-140 Controller manual.

3.1.7 SAFETY. - Operating and maintenance personnel are protected from accidental contact with electrical potentials in excess of 70 volts rms. No mechanical features are incorporated which may reasonably be expected to result in injury during normal operation or malfunctioning of the equipment.

3.1.8 IDENTIFICATION. - Each Paper-Tape Punch is identified by nameplate containing the applicable manufacturer's drawing number,

3. REQUIREMENTS (Cont'd)

serial number, name of equipment, model number, and specification number.

3.1.9 WORKMANSHIP. - The methods and techniques of workmanship used in the fabrication and assembly of parts, subassemblies and assemblies are consistent with the recognized and accepted standards for high-grade quality manufacturing of electro-mechanical equipment and are in accord with the current state-of-the-art practices.

3.1.10 DIMENSIONS

Chassis: 10 inches high, 17.5 inches wide, 14 inches deep
Panel: 10.5 inches high, 19.0 inches wide, 1/4 inch deep

3.1.11 WEIGHT. - 45 pounds.

4. QUALITY ASSURANCE PROVISIONS

4.1 GENERAL. - Inspections and tests are performed on each Paper-Tape Punch to determine compliance with the requirements of this specification. Records with validated results of the inspections and tests are kept complete and available to the customer.

4.2 CLASSIFICATION OF TESTS. - Tests consist of:

a. Inspection Tests
b. Performance Tests
c. Acceptance Tests

4.3 TEST CONDITIONS. - All tests are conducted with the equipment subjected to ambient atmospheric conditions as encountered within the test facility.

4.4 INSPECTION TESTS

## 4. QUALITY ASSURANCE PROVISIONS (Cont'd)

4.4.1 MECHANICAL TESTS. - Each Paper-Tape Punch is given a thorough mechanical and visual inspection to verify conformance to the applicable portions of this specification. Particular attention is given to the following:

a. Identification markings

b. Ease of operation of switches and other controls.

c. Proper operation of tape and paper threading spools and reels.

d. Quality of workmanship on parts, materials, and finishes.

4.4.2 ELECTRICAL TESTS. - Each Paper-Tape Punch is given all the electrical tests necessary to verify that the electrical circuits are properly wired, exhibit continuity, and conform to the specified requirements.

4.5 PERFORMANCE TESTS. - Each Paper-Tape Punch is given all performance tests necessary to verify conformance with the applicable requirements of this specification.

4.6 ACCEPTANCE TESTS. - Acceptance tests are performed by RW Division to verify compliance with the applicable portions of this specification.

## 5. PREPARATION FOR DELIVERY

5.1 Each Paper-Tape Punch is packed in a manner that will insure acceptance by domestic common carrier and safe delivery at destination. Shipping containers will comply with the Consolidated Freight Classification rules, or regulations of other carriers as applicable to the mode of transportation.

## 6. NOTES.

6.1 When the TRW-161 Paper-Tape Punch is purchased after delivery of a TRW-140 Controller, the following additional insert circuit cards will be required:

| Quantity | Type | RW Part Number |
|---|---|---|
| 1 each | Punch Control (8-Level) | 40021034 |
| 2 each | Punch Driver | 40019911 |

# EQUIPMENT SPECIFICATION
# TRW-185 INPUT/OUTPUT TYPEWRITER
# TRW-130 ELECTRONIC DATA PROCESSING SYSTEM
# 40015647

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Mgr., Manufacturing Program

THOMPSON RAMO WOOLDRIDGE INC.
RW DIVISION
CANOGA PARK, CALIFORNIA

# EQUIPMENT SPECIFICATION
# TRW-185 INPUT/OUTPUT TYPEWRITER

## 1. SCOPE

1.1 This specification covers one type of electromechanical input/output typewriter, designated the TRW-185 Input/Output Typewriter, intended for use with the TRW-140 Controller of the TRW-130 Data Processing System.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein.

### 2.1.1 SPECIFICATIONS

Thompson Ramo Wooldridge Inc., RW Division

| | |
|---|---|
| 40015646 | Equipment Specification, TRW-140 Controller. |

## 3. REQUIREMENTS

### 3.1 DESIGN

3.1.1 GENERAL DESCRIPTION. - The TRW-185 Typewriter is an 88-character, standard 44-key input/output typewriter, specified to include automatic carriage-return, remote case-shift, and remote keyboard-lock features.

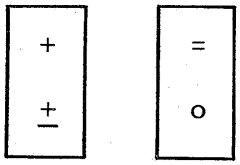
3.1.2 CARRIAGE. - The carriage has a platen 12 inches in width, accommodating paper 11 inches wide and permitting a 10.4-inch long writing line.

3.1.3 TYPE. - Letters of the alphabet and numerals are pica Gothic, single case (capital letters).

3.1.4 RATCHET. - The ratchet permits the typing of six lines per inch.

3.1.5 PITCH. - The pitch permits the typing of 10 characters per inch.

3.1.6 KEYBOARD. - The keyboard and controls are as provided in standard IBM input/output typewriters. Two blank keys are marked as follows:




3.1.7 INPUT-OUTPUT. - The TRW-185 Typewriter has 44 character-input positions and 44 character-output positions. Coding functions are external to the machine.

3.1.8 CONTROL CIRCUITS. - Control circuits specifically designed for use with the TRW-185 Typewriter are delivered with the Typewriter. These circuits are assembled on printed-circuit cards that plug into designated prewired receptacles of the TRW-140 Controller, defined in RW Equipment Specification 40015646. (See NOTES, 6.1)

3.1.9 INSTALLATION CRITERIA. - The TRW-185 is provided with four three-foot disconnectable cables for interconnection with the TRW-140. The TRW-185 has no specific installation requirements other than it must be located sufficiently close to the TRW-140 Controller to permit adequate bending radii of the interconnecting cables, and that sufficient space should be allowed at the rear for connector and cable clearance.

3.1.10 INTERFACE REQUIREMENTS. - Circuits providing interface between the TRW-185 Typewriter and the TRW-130 Computer, to accomplish data transmission and control of the Typewriter, are in the TRW-140 Controller. System interface is established by plug-in connection of the Typewriter to the TRW-140. (See NOTES, 6.1)

3.1.11 PRIMARY POWER. - The TRW-185 operates on primary power of 95 to 125 volts (117 volts nominal), 60 cps $\pm$10%, single phase.

3.1.12 SUPPORT DATA. - Two copies of each of the following are supplied with each TRW-185 Typewriter.

a. Operation Instructions
b. Maintenance Instructions
c. Schematics
d. List of Parts (name and part number)
e. List of Special Tools (name and part number)

NOTE: Operation and maintenance instructions are included in the TRW-140 Controller manual. The above items may be supplied in various combinations for convenient handling.

3.1.13 SAFETY. - Operating and maintenance personnel are protected from accidental contact with electrical potentials in excess of 70 volts rms. No mechanical features are incorporated which may reasonably be expected to result in injury during normal operation or because of malfunctioning of the equipment.

3.1.14 IDENTIFICATION. - Each TRW-185 Typewriter is identified by a nameplate containing the applicable manufacturer's drawing number, serial number, name of the equipment, model number, and specification number.

Control circuits are identified with an assembly drawing number.

3.1.15 WORKMANSHIP. - The methods and techniques of workmanship used in the fabrication and assembly of parts, sub-assemblies, and assemblies are consistent with the recognized and accepted standards for high-grade quality manufacturing of electro-mechanical equipment, and are in accord with current state-of-the-art practices.

3.1.16 DIMENSIONS (OUTLINE). - Standard 44-key keyboard, base and frame.

3.1.17 WEIGHT. - 75 pounds maximum.

3.1.18 FINISH. - The external finish of the TRW-185 Typewriter case is light gray. The keys have white letters on gray.

3.2 PERFORMANCE

3.2.1 OUTPUT SPEED. - The TRW-185 is capable of producing typewritten output at the rate of 10 characters per second.

3.2.2 ELECTRICAL REQUIREMENTS. - The electrical inputs are applied over 49 lines at a potential of 48V or 24V DC. The input current required for typing characters or holding the keyboard lock is 0.46 ampere. The electrical outputs are applied over 49 lines and the current required for actuating the typewriter controls or keyboard lock is 1.15 amperes.

3.2.3 OPERATING ENVIRONMENT. - The TRW-185 Typewriter is capable of satisfactory operation in the following type of environment:

a. Temperature: $0^{\circ}C$ to $40^{\circ}C$
b. Relative Humidity: 0% to 95%

## 4. QUALITY ASSURANCE PROVISIONS

4.1 GENERAL. - Inspections and tests are performed on each TRW-185 Typewriter to determine compliance with the requirements of this specification. Records with validated results of the inspections and tests are kept complete and available to the customer.

4.2 CLASSIFICATION OF TESTS. - Tests consist of

a. Inspection Tests
b. Performance Tests
c. Acceptance Tests

4.3 TEST CONDITIONS. - All tests are conducted with the equipment subjected to ambient atmospheric conditions as encountered within the test facility.

### 4.4 INSPECTION TESTS

4.4.1 MECHANICAL TESTS. - Each TRW-185 Typewriter is given a thorough mechanical and visual inspection to verify conformance to the physical requirements of this specification. Particular attention is given to the following:

a. Identification markings.
b. Ease of operation of keys, switches, and other controls.
c. Quality of workmanship on parts, materials, and finishes.

4.4.2 ELECTRICAL TESTS. - Each TRW-185 Typewriter is given all the electrical tests necessary to verify that the electrical circuits are properly wired, exhibit continuity, and conform to the specified requirements.

4.5 PERFORMANCE TESTS. - Each TRW-185 Typewriter is given all the performance tests necessary to verify conformance with the applicable portions of this specification.

4.6 ACCEPTANCE TESTS. - Acceptance tests are performed by RW Division to verify compliance with the applicable portions of this specification.

## 5. PREPARATION FOR DELIVERY

5.1 Each TRW-185 Typewriter is packed in a manner that will insure acceptance by domestic common carrier and safe delivery at destination. Shipping containers will comply with the Consolidated Freight Classification rules, or regulations of other carriers as applicable to the mode of transportation.

## 6. NOTES

6.1 CONTROL CIRCUITS. - If TRW-185 Typewriter control circuits are delivered as separate, individual circuit modules, they must be inserted into the appropriate receptacle locations of the TRW-140 by the equipment user. Instructions will be provided to facilitate the correct installation of these circuits, if applicable.

The following insert-circuit cards are required:

| Quantity | Type | RW Part Number |
|---|---|---|
| 1 each | Decode Matrix | 40020113-102 |
| 1 each | Decode Matrix | 40020113-103 |
| 1 each | Decode Matrix | 40020113-104 |
| 1 each | Decode Matrix | 40020113-105 |
| 1 each | Decode Matrix | 40020113-106 |
| 1 each | Decode Matrix | 40020113-107 |
| 1 each | Encode Matrix | 40020204-101 |
| 1 each | Encode Matrix | 40020204-102 |
| 1 each | Encode Matrix | 40020204-103 |
| 1 each | Encode Matrix | 40020204-104 |
| 9 each | Punch Driver | 40019911 |
| 1 each | Punch Driver | 40019911-101 |

EQUIPMENT SPECIFICATION

TRW-186 SEND-RECEIVE SET

TRW-130 ELECTRONIC DATA PROCESSING SYSTEM

40019790

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# EQUIPMENT SPECIFICATION
# TRW-186 SEND-RECEIVE SET

## 1. SCOPE

1.1 This specification covers one type of automatic send-receive set, designated the TRW-186 Send-Receive Set, which is essentially an operator-type, complete-station console that can be used to receive and print incoming messages, punch 5-level tape, and read 5-level tape for transmittal to other data processing units of the TRW-130 Data Processing System.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein.

### 2.1.1 SPECIFICATIONS

Thompson Ramo Wooldridge Inc., RW Division

| | |
|---|---|
| 40015646 | Equipment Specification TRW-140 Controller |

## 3. REQUIREMENTS

### 3.1 DESIGN AND PERFORMANCE

3.1.1 GENERAL DESCRIPTION. - The TRW-186 Send-Receive Set is an automatic message receiving, generating, and transmitting device. It is capable of simultaneously punching 5-level code, non-printed, chadless paper tape, and reading this tape for sequential distribution-transmittal to one or more receiving devices. It will also print or type copy either automatically from input signals or manually from keyboard input.

The TRW-186 is compatible with the TRW-140 Controller of the TRW-130 Data Processing System, and will receive data-signal outputs from the TRW-140 as well as transmit data-signal inputs to the TRW-140, which is defined in RW Specification 40015646. The insert-circuit cards required to achieve compatibility with the TRW-140 are inserted in the TRW-140, but are provided with the Send-Receive Set (See NOTES, 6.1.)

3.1.1.1 COMMUNICATION CODE. - The communication code consists of a start pulse, five intelligence pulses, and a stop pulse. The start pulse and each of the five intelligence pulses are of equal duration. The stop pulse is 1.42 times the length of each start or intelligence pulse. The signal frequency (number of current impulses followed by a no-current impulse) is 37.1 cps.

3.1.1.2 OPERATING SPEED. - The operating speed of the tape punch, tape reader, and typewriter/printer is nominally 600 characters per minute. Gears or gear sets are used to provide this operating speed and to provide adjustment to lower operating speeds.

3.1.1.3 PULSE DURATION. - At the 600 characters-per-minute speed, the time required to produce one character is no greater than 100 milliseconds. A unit pulse is 13.5 milliseconds in duration and a stop pulse is 19.2 milliseconds in duration.

3.1.2 COMPONENTS AND MOUNTING PROVISIONS. - The TRW-186 is comprised of the following major functional components and has provisions in the cabinet for mounting these components with convenient accessibility for maintenance or operating personnel:

a. Keyboard Base
b. Typing Unit
c. Electrical Service Unit

d. Motor Unit
e. Non-Typing Reperforator (Tape Punch)
f. Transmitter-Distributor (Tape Reader)
g. Transmitter-Distributor Base
h. Gear Set (Tape Punch Speed Gears)
i. Gear Set (Tape Reader Speed Gears)
j. Line Relay (to permit operation with 20 ma signal-line current)
k. Cabinet

3.1.2.1 OPERATOR CONTROLS. - The TRW-186 operator controls, exclusive of the keyboard, include an On-Off switch, Test-Line switch and an Automatic Send-Receive (ASR) Selector Control, which provide the following controls, respectively:

a. On-Off switch is a two-position toggle-switch for control of primary power input to the unit;
b. Test-Line switch is a two-position toggle-switch control for selecting either off-line or on-line operation of the unit;
c. The ASR selector control is a three-position rotary switch marked K (Keyboard), K-T (Keyboard-Tape), and T (Tape) to permit selection of one of these three operating modes: simultaneous transmission of messages and page printing (K); simultaneous transmission of messages and tape punching (K-T); or simultaneous tape punching and either reception of incoming messages or monitoring of transmittals from the tape reader (T).

3.1.2.2 INDICATORS. - The TRW-186 is provided with a characters-per-line indicator utilizing a moving arrow to indicate the number of characters typed. It also has a red-button margin indicator located above and to the right of the keyboard.

3.1.3 COMPONENT SPECIFICATIONS

3.1.3.1 KEYBOARD BASE

3.1.3.1.1 KEY DESIGNATION AND ARRANGEMENT. - The keyboard has a communications or alphanumeric-and-sign keyboard with the 32 transmission keys (including space bar) and provisions for 11 local control keys of which 7 are activated. The key designations and arrangement are as shown in Figure 1. Control keys are red with white characters. Alphanumeric and sign keys are grey-green with white characters.

3.1.3.1.2 FUNCTIONS. - The keyboard base provides the keyboard-coding, signal-generating, drive-linkage and switch-actuating functions in accordance with the schematic block diagram shown in Figure 2.

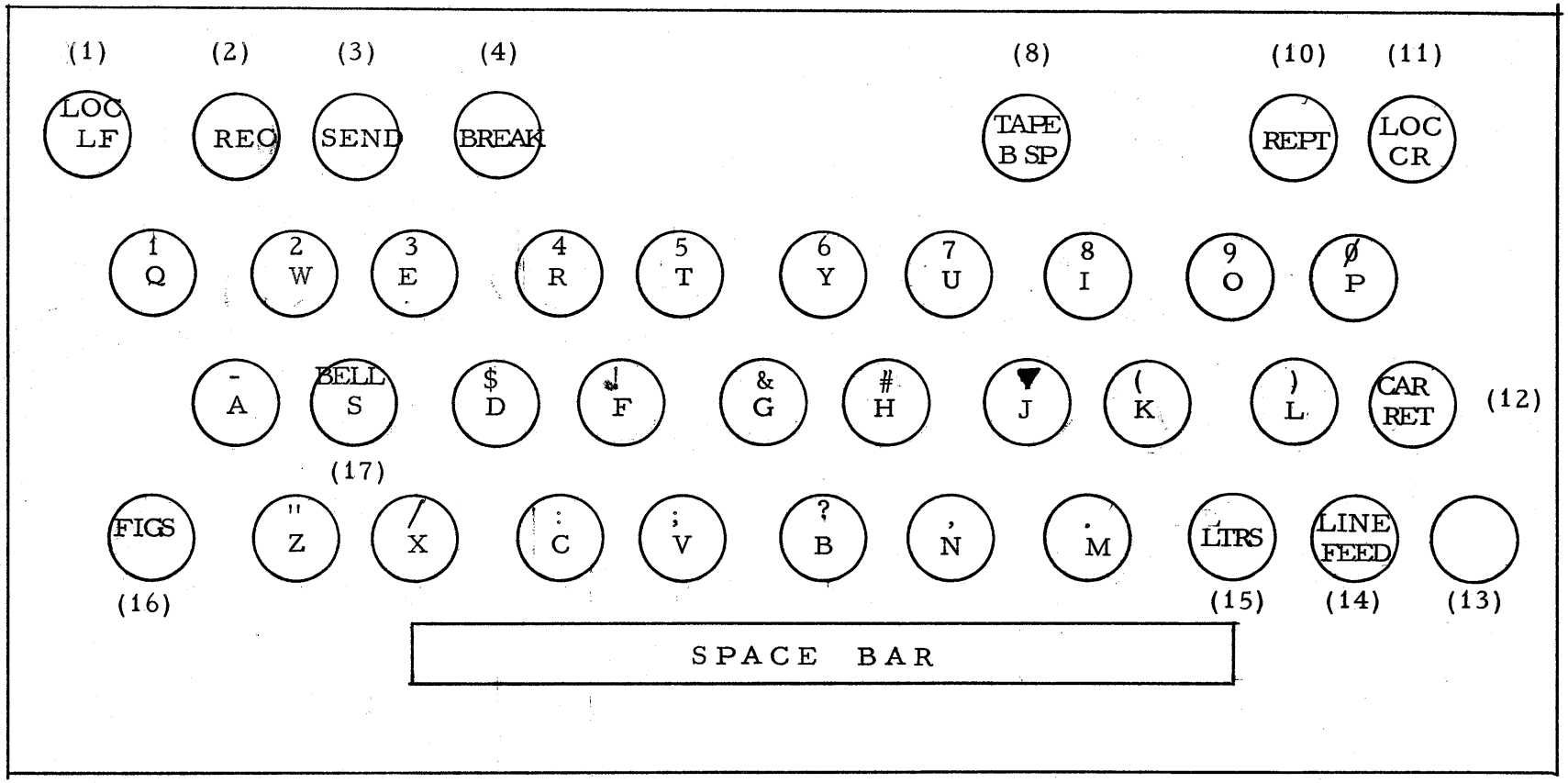
3.1.3.1.3 MOUNTING PLATFORM. - The keyboard base in addition to providing the functions specified above, serves as the mounting platform for the typing unit, motor unit and reperforator (tape punch).

3.1.3.1.4 SIGNAL CODE. - The keyboard 5-level signal code is organized as shown in Figure 3.

3.1.3.1.5 GEAR RATIO. - The gear ratio between the helical gear of the intermediate shaft assembly and that of the associated motor shaft is such that will provide an operating speed of 600 characters per minute.

3.1.3.2 TYPING UNIT

3.1.3.2.1 PLATEN. - The friction-feed platen of the typing unit is a rubber-covered cylinder or roller that is fixed to the platen shaft.




(1) Local Line Feed (No signal transmittal)
(2) Receive (On-line receive mode)
(3) Send (On-line send mode)
(4) Signal Line Break
(5), (6), (7) Not used
(8) Tape Backspace
(9) Not used
(10) Repeat (Continuous character or space transmittal)
(11) Local Carriage Return (No signal transmittal)
(12) Carriage Return (Transmits signal)
(13) Blank (Suppressed spacing and printing)
(14) Line Feed (Transmits signal)
(15) Letters Shift (Lower case)
(16) Figures Shift (Upper Case)
(17) Bell Signal in Upper Case (Printing and spacing suppressed)

Figure 1. Keyboard Layout

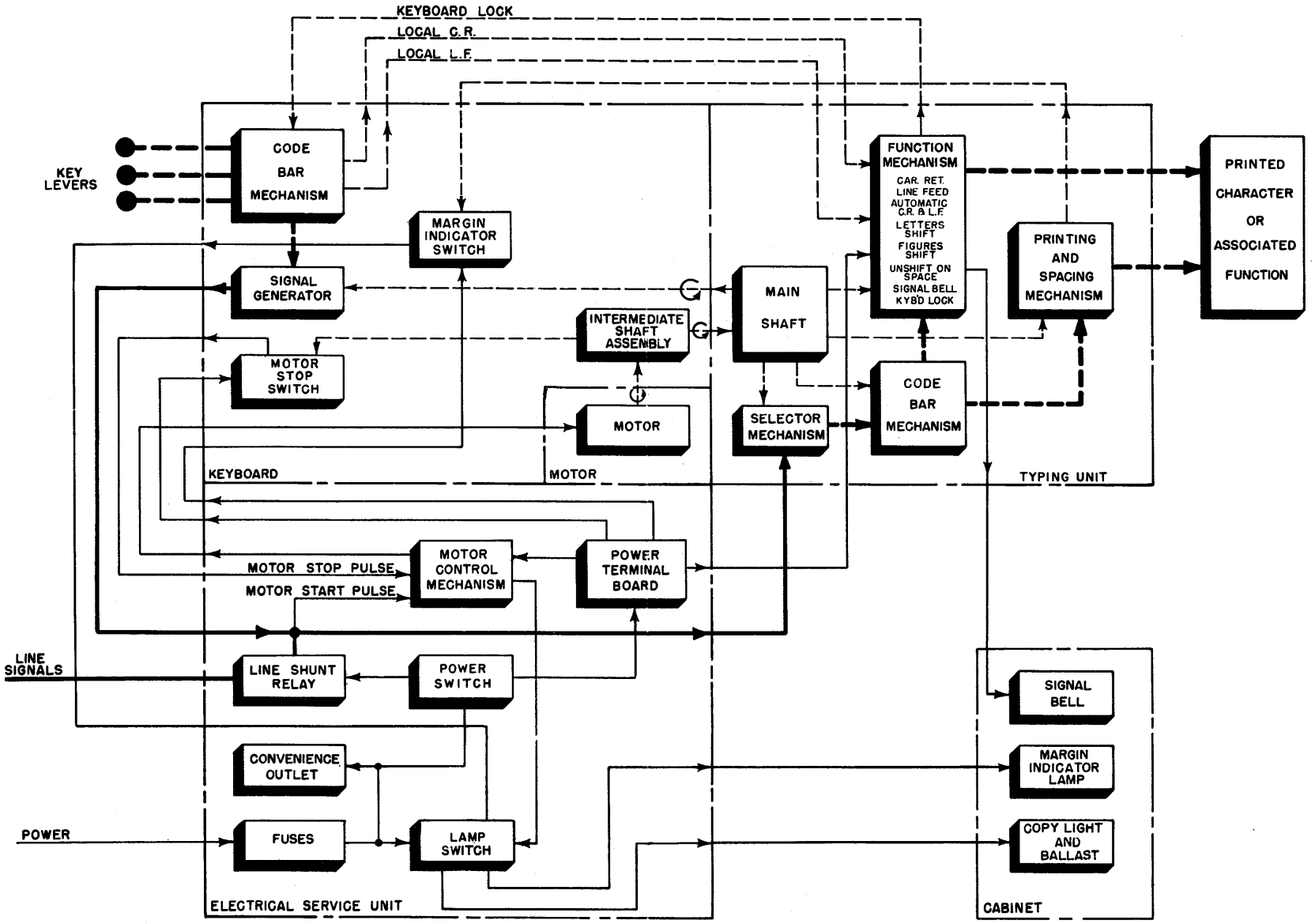



Figure 2. Console Components, Functional Block Diagram

| Figures | - | ? | : | $ | 3 | ! | & | # | 8 | | ( | ) | . | , | 9 | ø | 1 | 4 | Bell | 5 | 7 | ; | 2 | / | 6 | " | Blank | Ltrs | Figs | Space | CR | LF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Letters | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z | | | | | | |
| Numbers Indicate Marking or Current Impulses | 1 | 1 | | 1 | 1 | 1 | | | | 1 | 1 | | | | | | 1 | | 1 | | 1 | | 1 | 1 | 1 | 1 | | 1 | 1 | | | |
| | 2 | | 2 | | | | 2 | | 2 | 2 | 2 | 2 | | | | 2 | 2 | 2 | | | 2 | 2 | 2 | | | | | 2 | 2 | | | 2 |
| | | | 3 | | | 3 | | 3 | 3 | | 3 | | 3 | 3 | | 3 | 3 | | 3 | | 3 | 3 | | 3 | 3 | | | | 3 | | 3 | | |
| | | 4 | 4 | 4 | | 4 | 4 | | | 4 | 4 | | 4 | 4 | 4 | | | 4 | | | | 4 | | 4 | | | | 4 | 4 | | 4 | |
| | | 5 | | | | | 5 | 5 | | | | 5 | 5 | | 5 | 5 | 5 | | | 5 | | 5 | 5 | 5 | 5 | 5 | | 5 | 5 | | | |

*Numbers 1, 2, 3, 4, 5 indicate a chadless punch in each respective position.

Figure 3. Console 5-Level Character Codes*

The roller width is 8-3/4 inches to accommodate paper widths up to 8-1/2 inches. The margin is adjustable to any position from 1 to 85 characters.

3.1.3.2.2 TYPE-STYLE AND SPACING. - The type style is Murray with 10 characters-per-inch horizontal single spacing and 6 lines-per-inch single spacing (3 lines-double spacing).

3.1.3.2.3 FUNCTIONS. - The typing unit has provisions for a main drive shaft to engage two components of the keyboard base and includes the selector, code-bar, keyboard-function and printing-spacing mechanisms interconnected as shown in Figure 2.

3.1.3.2.4 TYPE BOX. - The type box of the printing and spacing mechanism contains the necessary type pallets, appropriately arranged to provide the printing of the letters, figures and signs shown in Figure 1.

3.1.3.2.5 FUNCTION BOX. - The function or stunt box of the function mechanism contains the necessary code bars, appropriately arranged to provide the correct typing unit action in response to keyboard function or control key selections. It has the following functions:

| Mandatory Slot Position | Arbitrary Slot Position | Function |
|---|---|---|
| 1 | | Unshift-on-Space |
| 2 | | Figures Shift |
| 3 | | Letters Shift |
| 4 | | Automatic Carriage Return and Line Feed |
| 5 | | Keyboard Carriage Return |
| | 6-27 | Not Used |

| Mandatory Slot Position | Arbitrary Slot Position | Function |
|---|---|---|
| 28 | | Signal Bell (upper case S) |
| | 29-34 | Not Used |
| 35 | | Blank (non-space and non-print) |
| 36 | | Blank (non-space and non-print) (Note: double blank locks keyboard) |
| | 37 | Not Used |
| 38 | | Space (for line feed) |
| 39 | | Space (used with slot No. 4) |
| 40 | | Line Feed (with print condition) |
| | 41-42 | Not Used |

3.1.3.2.6 SIGNAL-RECEIVING CIRCUIT. - The selector mechanism of the typing unit has in the receiving circuit two 132-ohm selector magnet coils wired to a connector to receive the signals from the signal generator of the keyboard base for routing to the typing unit code-bar mechanism for character-function selection.

3.1.3.3 ELECTRICAL SERVICE UNIT

3.1.3.3.1 DESIGN. - The electrical service unit is a removable chassis designed for the mounting of switches, fuses, terminal boards, convenience receptacle, line-shunt relay and plug-in line relay. It contains the electrical cabling to interconnect the keyboard base, typing unit and cabinet electrical panels.

3.1.3.3.2 FUNCTION. - This unit is interconnected to the electrical components and associated major functional components as shown in Figure 2.

3.1.3.4 MOTOR UNIT. - The motor unit is a synchronous motor designed to operate with the input power specified in 3.5 herein. It is a 1/20 horsepower, 3600 rpm, two-pole, wound-stator, ball-bearing motor with a squirrel-cage type rotor. The motor meets the following requirements:

| | | |
|---|---|---|
| a. | Starting Current | 9.0 amperes |
| b. | Running Current | 1.8 amperes |
| c. | Power Factor | 0.3 |
| d. | Wattage | 65 watts |
| e. | Heat Dissipation | 50 watts |
| f. | Rotation (from fan end) | CCW |
| g. | Circuit Protection | Thermal Overload Cutout |

3.1.3.5 NON-TYPING REPERFORATOR. - The non-typing reperforator is a 600-character-per-minute, one-cycle tape punch for handling standard 11/16-inch paper tape and punching five-level chadless code holes, 10 code characters per inch with feed hole and code holes in line. A gear set is provided to accommodate the reperforator speed to that of the keyboard base power shaft.

3.1.3.5.1 SPECIAL FEATURES. - The reperforator is a two-shaft device to permit variation in the operating speed of the perforating mechanism and the selecting mechanism. The reperforator has a backspace mechanism to permit the deletion of erroneously perforated codes.

3.1.3.5.2 OPERATING INPUTS. - Punching action occurs either from signal pulses received by a selector or from manual input on the keyboard. The signal code is sequential, five-unit, start-stop pulses.

3.1.3.6 TRANSMITTER-DISTRIBUTOR AND BASE. - The transmitter-distributor is a 600-character-per-minute punched paper tape reader for reading standard 11/16-inch paper tape and translating 5-level code combinations into electrical pulses for distribution and transmittal to one or more receiving stations. A gear set is provided to accommodate the transmitter-distributor speed to that of the keyboard base power shaft. The unit is mounted on a base that mounts to the cabinet and has the necessary drive linkage for the transfer of mechanical power from the keyboard base.

3.1.3.6.1 SPECIAL FEATURES. - The transmitter-distributor is a fixed-head, single-contact tape reader with a selection switch to control starting and stopping, the feeding of tape, and the free wheeling of tape. A tight-tape control device is incorporated to stop transmission when the tape becomes taut or tangled. A quick disconnect, 36-terminal connector plug is provided to simplify and facilitate electrical connections to the various associated components.

3.1.3.6.2 OVERLOAD PROTECTION. - External overload protection must be provided for the unit.

3.1.3.7 CABINET. - The cabinet is a combination support and enclosure console with a hinged cabinet hood which gives access to all mounted components. Individual doors on the hood provide localized access to individual components for replacement purposes, or for minor adjustments and service. Levelers are incorporated in the cabinet base.

3.1.3.7.1 CONTROL, ELECTRICAL AND TYPING ACCESSORIES. - The cabinet contains the various control, electrical and typing accessories required to operate the unit. These accessories include the following:

a. Signal Bell
b. Transformer
c. Outlet Box Connectors (2) and Fuse (4 amp)
d. Keyboard Selector Control (K, K-T, T)
e. Power Control (Test-Line and On-Off)
f. Copyholder
g. Copy Light and Ballast
h. Tape Bin
i. Electrical Distribution Panel and Cables
j. Message Processing Panel and Cable
k. Tape Preparation Panel and Cable
l. Power Supply (DC)
m. Translator Panel and Cable
n. Alarm Panel and Cable
o. Intercept Panel and Cables
p. Terminal Boards, Connector and Cable Assembly

3.1.4 OPERATING ACCURACY. - The TRW-186 Send-Receive Set is capable of operating in any of its modes with an accuracy of less than one error per $5 \times 10^5$ characters.

3.2 SYSTEM INTERFACE. - The circuits used to provide interface between the TRW-186 Send-Receive Set, and the TRW-140 are supplied as separate individual circuit modules for installation in the TRW-140. Interface is established by plug-in connection of the TRW-186 to the TRW-140. (See NOTES, 6.1.)

3.3 INSTALLATION CRITERIA. - The TRW-186 Send-Receive Set is a self-contained unit and has no installation requirements relative to mounting and securing. However, the unit should be located in an area that affords operator comfort and convenience and compatibility with system operation and intended use.

Interconnecting and power cables approximately 10 feet long enter and leave the Send-Receive Set through the bottom of the cabinet at the rear. Sufficient clearance exists between the rear panel of the unit and

the supporting surface for the cables to enter and leave the cabinet. The rear panel contains louvers that permit the air-cooling of internal components. Care should be taken not to install the unit such that the louver panels are in any way obstructed.

3.4 ENVIRONMENTAL CRITERIA. - The TRW-186 Send-Receive Set is capable of satisfactory operation without any degradation of performance when operating in environments with ambient temperatures ranging from $0^{\circ}$ to $50^{\circ}$C, relative humidity up to 80 percent, and barometric pressures ranging from 30 to 24.7 inches of mercury (sea level to approximately 6000 feet above sea level).

3.5 POWER REQUIREMENTS. - The TRW-186 is designed to operate on a primary power input of 115 volts (plus or minus 10%), 60 cycles (plus or minus 0.5 cycle) single-phase alternating current. The power consumption is 200-watts (maximum).

3.6 SUPPORT. - Two copies of each of the following are supplied with each TRW-186 Send-Receive Set.

(a) Operation Instructions
(b) Maintenance Instructions
(c) Schematics
(d) List of Parts (name and part number)
(e) List of Special Tools (name and part number)

NOTE: Operation and maintenance instructions and schematics are supplied in a single manual.

3.7 SAFETY. - No mechanical or electrical features are incorporated which may reasonably be expected to result in injury to personnel during normal operation or because of equipment malfunction.

3.8 IDENTIFICATION. - Each TRW-186 Send-Receive Set is identified by a nameplate containing the applicable assembly drawing number, serial number, name of equipment, model number and specification number.

3.9 WORKMANSHIP. - The methods and techniques of workmanship used in the fabrication and assembly of parts, subassemblies, and assemblies are consistent with the recognized and accepted standards for high-grade quality manufacturing of electromechanical equipment and are in accord with the current state-of-the-art practices.

3.10 DIMENSIONS.

(a) Height: 39 inches
(b) Width: 36 inches
(c) Depth (including keyboard): 23 inches

3.11 WEIGHT. - Approximately 260 pounds

3.12 FINISH. - The external surfaces of the TRW-186 Send-Receive Set are finished smooth with a vinyl base paint of gray-green color.

4. QUALITY ASSURANCE PROVISIONS

4.1 GENERAL. - Inspections and tests are performed on each TRW-186 Send-Receive Set to verify compliance with the requirements of this specification. Records with validated results of the inspections and tests are kept complete and are available to the customer.

4.2 CLASSIFICATION OF TESTS. - Tests consist of:

a. Inspection Tests
b. Performance Tests
c. Acceptance Tests

4.3 TEST CONDITIONS. - All tests are conducted with the equipment subjected to ambient atmospheric conditions as encountered within the test facility.

4.4 INSPECTION TESTS

4.4.1 MECHANICAL TESTS. - Each TRW-186 Send-Receive Set is given a thorough mechanical and visual inspection to verify conformance with the physical requirements of this specification. Particular attention is given to the following:

(a) Identification markings
(b) Ease of operation of keys, switches and other controls
(c) Proper operation of tape threading spools and reels
(d) Quality of workmanship on parts, materials, and finishes

4.4.2 ELECTRICAL TESTS. - Each TRW-186 is given all the electrical tests necessary to verify that the electrical circuits are properly wired, exhibit continuity, and conform to the specified requirements.

4.5 PERFORMANCE TESTS. - Each TRW-186 is given all performance tests necessary to verify conformance with the applicable requirements of this specification.

4.6 ACCEPTANCE TESTS. - Acceptance tests are performed by RW Division to verify compliance with the applicable portions of this specification.

## 5. PREPARATION FOR DELIVERY

5.1 Each TRW-186 is packed in a manner that will insure acceptance by domestic common carrier and safe delivery at the consigned destination. Shipping containers will comply with the Consolidated Freight Classification rules, or regulations of other carriers as applicable to the mode of transportation.

## 6. NOTES

6.1 The following insert circuit cards are provided with the TRW-186 Send-Receive Set when it is purchased after delivery of a TRW-140 Controller to the customer:

| Quantity | Type | RW Part No. |
|---|---|---|
| 4 each | Delay Flip-Flop | 40015168 |
| 2 each | Half Adder | 40015190 |
| 1 each | Teletype Output Driver | 40019908 |
| 1 each | Decode Matrix | 40020113-109 |
| 1 each | Decode Matrix | 40020113-112 |
| 1 each | Send-Receive Control | 40020197 |

# EQUIPMENT SPECIFICATION
# TRW-188 SEND-RECEIVE SET
# TRW-130 ELECTRONIC DATA PROCESSING SYSTEM
# 40021518

Issued: 15 September 1962

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THOMPSON RAMO WOOLDRIDGE INC.
RW DIVISION
CANOGA PARK, CALIFORNIA

# EQUIPMENT SPECIFICATION
# TRW-188 SEND-RECEIVE SET

## 1. SCOPE

1.1 This specification covers the TRW-188 Send-Receive Set, herein called the Send-Receive Set, which is used with the TRW-130 Digital Computer as an input-output device. The Send-Receive Set is comprised of two main parts: 1) a data-message station (Teletype Set) consisting of a typing unit, a paper tape punch, a transmitting and receiving device, and associated electrical and mechanical devices, and 2) a modification kit for the TRW-130 Computer which adapts it for use with the Teletype Set.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein.

### 2.1.1 SPECIFICATIONS

Thompson Ramo Wooldridge Inc., RW Division

| | |
|---|---|
| 40015645 | Equipment Specification, AN/UYK-1 (TRW-130) Digital Computer |

### 2.1.2 DRAWINGS, TRW-188 MODIFICATION KIT

Thompson Ramo Wooldridge Inc., RW Division

| | |
|---|---|
| 400949 | Specification Control Drawing, Console, Send-Receive (Automatic) |
| 40015174 | Card Assembly, Set Reset Flip-Flop |
| 40021411 | Logic, GP |
| 40021682 | Send-Receive Set, TRW-188 |
| 40021683 | Wire List, TRW-188 Adapter |
| 40022391 | Cable, TRW-188 to TRW-130 |

## 3.1 DESIGN

3.1.1 GENERAL. - Compatibility between the Send-Receive Set and the TRW-130 Digital Computer is achieved by the use of plug-in insert circuit cards in the computer. Data can be entered into the computer either directly from the keyboard or from previously prepared 5-level paper tape. Output data from the computer can be read directly on the page printer. The Send-Receive Set is designed to operate at 600 characters per minute.

3.1.2 COMPUTER MODIFICATION. - The TRW-188 modification to the TRW-130, which is defined in the drawings listed in paragraph 2.1.2, allows the Teletype Set to communicate with the computer serially. Adapting circuitry consists of two Set-Reset flip-flops on one card in connector L03, an amplifier added to the LI Board in connector L02 and the use of Input Amplifier Section 3 in connector L26. The two flip-flops are the "Receive/Send" flip-flop and the "Spacing/Marking" flip-flop. No changes have been made in the Teletype Set itself, and all data to or from the set travels over a conventional two-wire Teletype circuit (see Figure 1). The set must be equipped however, with a Teletype Corp. "Line Relay". This is standard Teletype equipment but must be specified in ordering.

3.1.3 TECHNICAL DESCRIPTION-INPUT. - The Teletype circuit is conducting when the set is idle. This current is supplied by the normal output of a flip-flop which has been added to the computer. The circuit is said to be "Marking" when current is flowing. When a key is depressed on the Teletype keyboard, or when the paper tape reader (transmitter-distributor) transmits a character, this circuit is opened and closed in a pattern which sends the code:

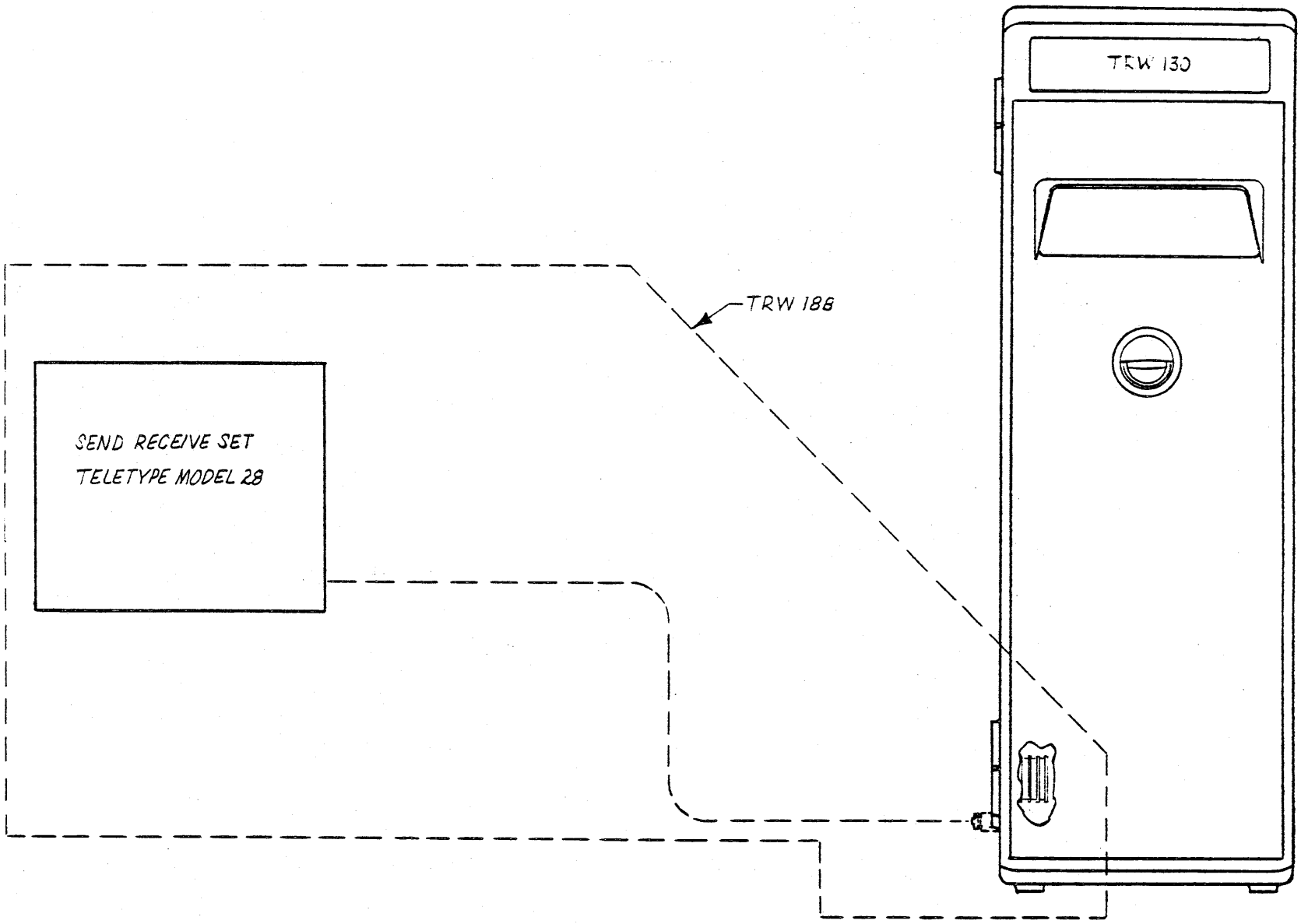
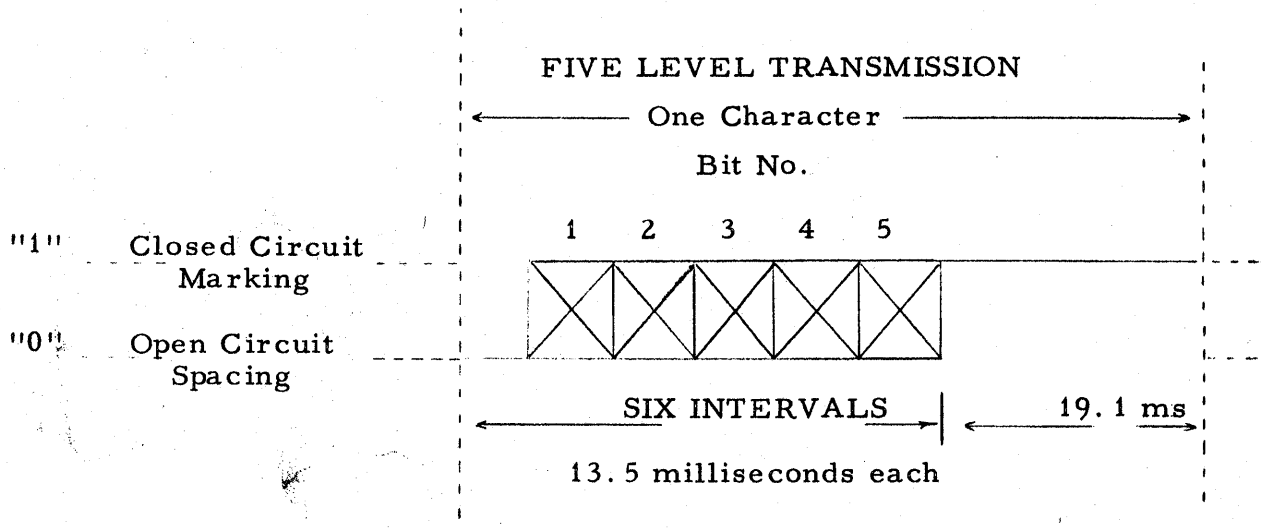



Figure 1. Connection to TRW-130 Computer

40021518




Note that the first of six equal intervals in the transmission of a character is always SPACING. The code bits are numbered above to correspond with Teletype terminology.

The input circuit to the added amplifier detects the opening and closing of the Teletype circuit by monitoring the current on the line. Having been set to the receive state, this circuit simulates Interrupt Line IIN3 TRUE whenever the Teletype circuit is SPACING. It is suggested that the computer be programmed so that the first SPACING interval of a Teletype code interrupts the computer and that the actual code bits of the character are then timed out in an Interrupt subroutine. The Interrupt Line IIN3 (bit 2 in the status word) should be sampled in the middle of each 13.5-millisecond interval. After the initial SPACING interrupt is received, the interrupt is to be blocked until some time after the sixth 13.5-millisecond interval.

3.1.4 TECHNICAL DESCRIPTION-OUTPUT. - The computer transmits data to the Teletype Set by setting and resetting a flip-flop with the Cable C External Function codes 00006 and 00002 respectively. This flip-flop must be turned on to transmit a SPACING bit for 13.5 msec. before the code bits are transmitted. Each code bit is 13.5 msec. long and a minimum MARKING interval of 19.1 msec. is required at the completion of a character. The "Receive/Send" flip-flop is reset during this time so that the computer is not interrupted by its own transmission.

The computer controls teletype transmission and interrupt blocking with Cable C External Function commands, although wiring is such that no external connection need be made to the Cable C Connector. (See RW Equipment Specification 40015645.)

The applicable codes are as follows:

| Cable C External Function Code | Function Performed |
|---|---|
| 00000 | Sets to receive state; teletype "spacing" causes interrupt |
| 00002 | Sends "marking" to teletype; sets interrupt block |
| 00004 | Sends "spacing" to teletype. Does NOT set interrupt block: DO NOT USE. |
| 00006 | Sends "spacing" to teletype. Sets interrupt block. |

3.1.5 COMPONENTS. - The Send-Receive Set consists of the following components:

a. Page Printer
b. Send-Receive Keyboard
c. Synchronous Motor Unit
d. Electrical Service Unit
e. Tape Punch (Non-Typing Reperforator)
f. Tape Reader (Transmitter-Distributor)
g. Cabinet

3.1.6 OPERATOR CONTROLS. - The operator controls (excluding those on the keyboard) are as follows:

| Designation | Function |
|---|---|
| ON/OFF | The ON/OFF switch, located on the console below the right hand side of the keyboard, is a two position switch that applies and removes operating power. |
| TEST/LINE | The TEST/LINE switch, located on the console below the left hand side of the keyboard, is a two position switch that selects either local or on-line operation of the Send-Receive Set. |
| K/K-T/T | The K/K-T/T switch, located on the console to the left of the keyboard, is a three position switch that selects either the K (keyboard), K-T (keyboard-tape), or T (tape) operating mode. |

3.1.6.1 CHARACTER COUNTER. - The keyboard incorporates a character counter for use during tape perforation when the page printer is not used for monitoring. The character counter registers the count of characters being perforated in relation to the position they would occupy on a page printer line.

3.1.7 KEYBOARD. - The key designations and arrangement of the keyboard are as shown in Figure 2. The keyboard designations are self-explanatory with the following exceptions:

| Designation | Key Function |
|---|---|
| LOC LF | Local line feed (no signal transmitted). |
| REC | Sets on-line receive mode. |
| SEND | Sets on-line send mode. |
| BREAK | Signal line break. |
| TAPE B SP | Backspaces the paper tape one character for each time pressed. Used in conjunction with LTRS key for correcting tape errors. |
| REPT | Repeat continuous character or space transmittal. |
| LOC CR | Local carriage return (no signal transmitted). |
| BELL | Bell signal in upper case (printing and spacing suppressed). |
| CAR RET | Returns carriage and transmits carriage return signal. |
| FIGS | Shifts to upper case operation. |
| LTRS | Shifts to lower case operation. Used in conjunction with TAPE B SP key for correcting tape errors. |
| Blank Key | Feeds out unperforated paper tape one character for each time pressed. |

3.1.8 SIGNAL CODE. - The punching of the 11/16 inch paper tape is chadless, and the signal code is as shown in Figure 3. Ten code holes are punched per inch of tape.

3.1.9 COMMUNICATION CODE. - The output communication code consists of a start pulse, five intelligence pulses, and a stop pulse. The start pulse and each of the five intelligence pulses are of equal duration. The stop pulse is 1.42 times the length of each start or intelligence pulse. The signal frequency (number of current pulses followed by a no-current impulse) is 37.1 cps.

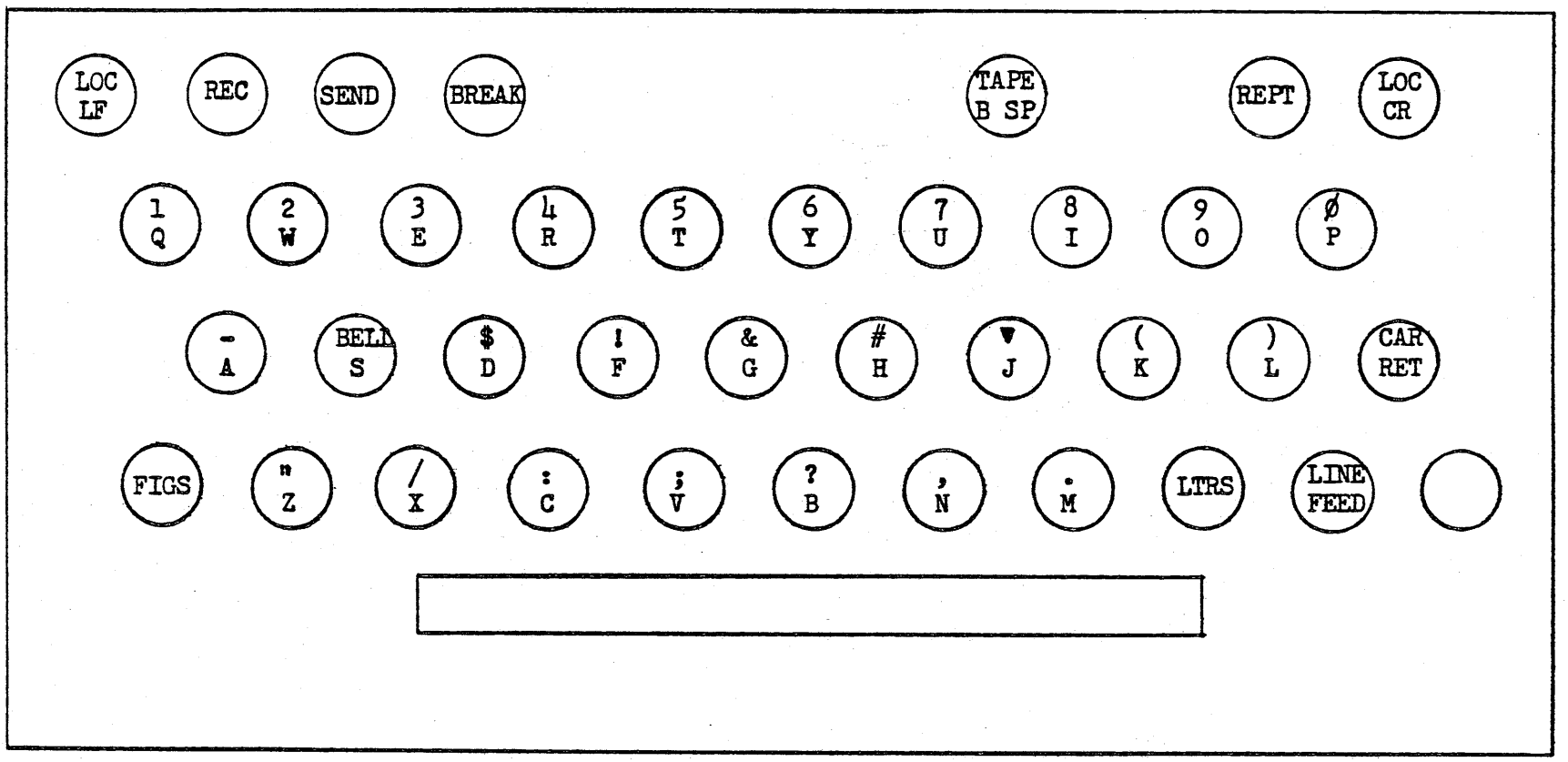



**Figure 2. Keyboard Layout**

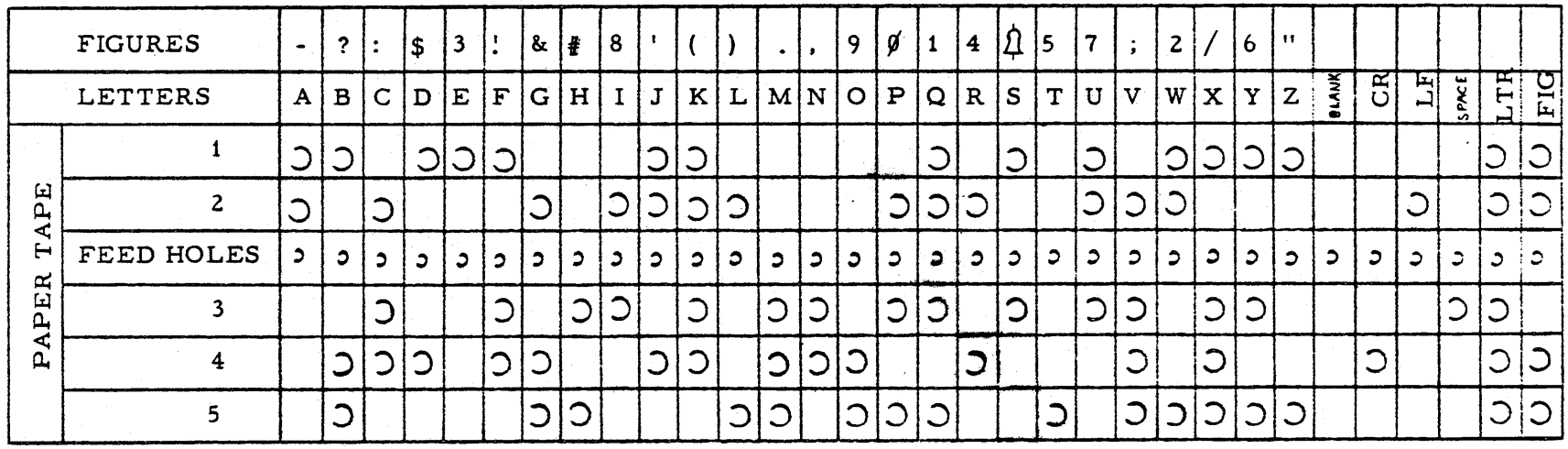



Figure 3. Paper Tape Signal Code

3.1.10 POWER REQUIREMENTS. - The Send-Receive Set operates on 115 volts ±10%, 60 cps ±0.5 cps, single phase power, and consumes less than 200 watts.

3.1.11 INSTALLATION CRITERIA. - No specific site preparation procedures are required for installation. System location is at the discretion of the user as long as adequate space is provided. No special cable trays or raceways are required for interconnecting cabling between the cabinet assemblies or individual cabinets. No special cooling or air-conditioning ducts are required.

3.1.12 SUPPORT DATA. - Two copies of each of the following are supplied with each Send-Receive Set.

a. Operation Manual
b. Maintenance Manual
c. Schematics
d. List of Parts (name and part number)
e. List of Special Tools (name and part number)

Note: The above items may be provided in various combinations for convenient handling.

3.1.13 SAFETY. - No mechanical or electrical features are incorporated which may reasonably be expected to result in injury to personnel.

3.1.14 IDENTIFICATION. - Each Send-Receive Set is identified with a nameplate containing the applicable drawing number, serial number, name of equipment, model, and specification number.

3.1.15 WORKMANSHIP. - The methods and techniques of workmanship used in the fabrication and assembly of parts, subassemblies, and assemblies is consistent with the recognized and accepted standards for high-grade quality manufacturing of electromechanical equipment and is in accord with the current state-of-the-art practices.

3.1.6 DIMENSIONS

| | |
|---|---|
| Height: | 39 inches |
| Width: | 36 inches |
| Depth (including keyboard): | 23 inches |

3.1.7 WEIGHT. - The weight of the Send-Receive Set is approximately 260 pounds.

3.1.8 COLOR. - The external finish of the Send-Receive Set is gray-green in color.

3.2 PERFORMANCE

3.2.1 OPERATING SPEED. - The operating speed of the Send-Receive Set is nominally 600 characters per minute.

3.2.2 OPERATION OF K/K-T/T SWITCH

| Position | Function |
|---|---|
| K | In the K (for "Keyboard") setting, the keyboard can be used to transmit messages directly to another station or group of stations. A record of the message is made available on the page printer for monitoring, immediate processing, or future reference. |
| K-T | In the K-T (for "Keyboard-Tape") setting, the keyboard can be used to perform the dual operations of transmitting messages electrically while simultaneously perforating tape by mechanical means. |
| T | In the T (for "Tape") setting, the keyboard can be used for the direct, mechanical perforation of tape at a nominal speed of 600 characters per minute. In this setting the page printer is available for the receipt of incoming messages or to monitor transmission from the transmitter-distributor. |

3.2.3 OPERATION OF LINE-TEST SWITCH. - The Line-Test switch in the TEST position simply shorts out the signal line for off-line operation. In the LINE position, the switch permits on-line operation.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 GENERAL. - Inspections and tests are performed on each Send-Receive Set to verify compliance with the requirements of this specification. Records with validated results of the inspections and tests are kept complete and are available to the customer.

4.2 CLASSIFICATION OF TESTS. - Tests consist of:

a. Inspection Tests

b. Performance Tests

c. Acceptance Tests

4.3 TEST CONDITIONS - All tests are conducted with the equipment subjected to ambient atmospheric conditions as encountered at the test facility.

### 4.4 INSPECTION TESTS

4.4.1 MECHANICAL TESTS. - Each Send-Receive Set is given a thorough mechanical and visual inspection to verify conformance with the physical requirements of this specification. Particular attention is given to the following:

a. Identification markings.

b. Ease of operation of switches and other controls.

c. Quality of workmanship on parts, materials, and finishes.

4.4.2 ELECTRICAL TESTS. - Each Send-Receive Set is given all electrical tests necessary to verify that the electrical circuits are properly wired, exhibit continuity, and conform to the specified requirements.

4.5 PERFORMANCE TESTS. - Each Send-Receive Set is given all performance tests necessary to verify conformance with the applicable requirements of this specification.

4.6 ACCEPTANCE TESTS. - Acceptance tests are performed by the RW Division to verify compliance with the applicable portions of this specification.

5. PREPARATION FOR DELIVERY

5.1 Each Send-Receive Set is packed in a manner that will insure acceptance by domestic common carrier and safe delivery at destination. Shipping containers will comply with the Consolidated Freight Classification rules, or regulations of other carriers as applicable to the mode of transportation.

6. NOTES. - None.

EQUIPMENT SPECIFICATION

TRW-194 MOTOR-ALTERNATOR SET

TRW-130 ELECTRONIC DATA PROCESSING SYSTEM

40020035

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THOMPSON RAMO WOOLDRIDGE INC.
RW DIVISION
CANOGA PARK, CALIFORNIA

# EQUIPMENT SPECIFICATION
# TRW-194 MOTOR-ALTERNATOR SET

## 1. SCOPE

1.1 This specification covers the TRW-194 Motor-Alternator Set, which is intended for use as a transient-free, regulated AC power supply for the TRW-130 Electronic Data Processing System.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein.

### 2.1.1 MILITARY SPECIFICATIONS

| | |
|---|---|
| MIL-E-15090 | Enamel, Equipment, Light Gray (Formula No. 111) |

### 2.1.2 OTHER SPECIFICATIONS

Thompson Ramo Wooldridge Inc., RW Division

| | |
|---|---|
| 40015645 | Equipment Specification, AN/UYK-1 (TRW-130) Digital Computer |

# 3. REQUIREMENTS

## 3.1 DESIGN

3.1.1 GENERAL. - The Motor-Alternator Set consists of the motor-alternator unit, the regulator-exciter and magnetic starter unit, and the maintained-contact switch unit.

3.1.2 MOTOR-ALTERNATOR. - The drive motor is a 4 HP induction motor with a rated input of 220/440 volt, 60 CPS, three-phase, at 2.7 KVA. The Motor-Alternator provides a 118 volt, 400 CPS, single-phase output rated at 1.5 KVA (at unity power factor).

3.1.3 REGULATOR-EXCITER. - The regulator-exciter provides output voltage regulation and voltage for alternator excitation.

3.1.4 MAGNETIC STARTER. - The magnetic starter for the Motor-Alternator drive motor is designed for 220/440 volt operation.

3.1.5 MAINTAINED-CONTACT SWITCH. - The maintained-contact switch provides induction drive motor control.

3.1.6 INSTALLATION CRITERIA. - The Motor-Alternator Set is designed to be connected between a 220/440 volt, 60-cycle, three-phase primary power source and the TRW-130 Digital Computer. The unit can be placed in any convenient location near the computer without a stringent requirement for ready accessibility, once installation has been completed and cable connections made.

NOTE: The cable assemblies furnished with the Motor-Alternator Set may not necessarily meet the building code requirements of the particular installation.

3.1.7 SUPPORT DATA. - Two copies of each of the following are supplied with each Motor-Alternator Set:

a. Operation Instructions

b. Maintenance Instructions

c. Schematics

d. List of Parts (name and part number)

e. List of Special Tools (name and part number)

NOTE: Operation and maintenance instructions and schematics will be provided in the TRW-130 Computer manual.

3.1.8 SAFETY. - A circuit breaker is provided on the Motor-Alternator Set output for short circuit protection. No mechanical or electrical features are incorporated which may reasonably be expected to result in injury to personnel during normal operation or because of malfunctioning of the equipment.

3.1.9 IDENTIFICATION. - Each Motor-Alternator Set is identified by a nameplate containing the applicable manufacturer's drawing number, serial number, name of equipment, model number, and specification number.

3.1.10 WORKMANSHIP. - The methods and techniques of workmanship used in the fabrication and assembly of parts, subassemblies, and assemblies are consistent with the recognized and accepted standards for high-grade quality manufacturing of electromechanical equipment and are in accord with the current state-of-the-art practices.

3.1.11 DIMENSIONS

| | |
|---|---|
| Length: | 28.25 inches |
| Width (overall): | 13.75 inches |
| Height (maximum): | 10 inches |

3.1.12 WEIGHT. - The weight of the Motor-Alternator Set is approximately 200 pounds.

3.1.13 COLOR. - The external finish of the Motor-Alternator Set is painted with light gray enamel, Formula 111, Type III, Class 2, per MIL-E-15090.

3.2 PERFORMANCE

3.2.1 INPUT VOLTAGE AND FREQUENCY VARIATIONS. - The Motor-Alternator Set operates satisfactorily during the following input conditions.

3.2.1.1 With nominal 220/440 volt, 60 CPS, three-phase input power.

3.2.1.2 With steady-state input voltage variations of ± 10% from nominal, plus additional transient voltage variations of ± 20% (transient voltage variations starting from any point within the steady-state band and recovering to a point within the steady-state band within 2 seconds).

3.2.1.3 With steady-state frequency variations of ± 5% from nominal, plus additional transient deviations of ± 3% (transient frequency deviations not exceeding the steady-state tolerance band of ± 5% by more than 1%, and recovering to a point within the steady-state band within 2 seconds).

3.2.2 OUTPUT VOLTAGE REGULATION. - The Motor-Alternator Set provides nominal 118 volt, 400 CPS, single-phase output power rated at 1.5 KVA (unity power factor). The output voltage is regulated to within ± 1V from nominal during normal operation. During application or removal of full load conditions, or during input voltage transient conditions described in 3.2.1.2, the output voltage may vary an additional ± 1 volt if 70% recovery occurs within 300 milliseconds.

3.2.3 VOLTAGE MODULATION. - The maximum voltage modulation at any load is 0.33% maximum.

3.2.4 HARMONIC CONTENT. - The maximum RMS harmonic content (measured from line-to-line) with any load is 3% maximum.

3.2.5 ENVIRONMENTAL CRITERIA. - The Motor-Alternator Set is capable of satisfactory operation throughout the ambient temperature range of 0°C to 50°C.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 GENERAL. - Inspections and tests are performed on each Motor-Alternator Set to determine compliance with the requirements of this specification. Records with validated results of the inspections and tests are kept complete and available to the customer.

4.2 CLASSIFICATION OF TESTS. - Tests consist of:

a. Inspection Tests
b. Performance Tests
c. Acceptance Tests

4.3 TEST CONDITIONS. - All tests are conducted with the equipment subjected to ambient atmospheric conditions as encountered within the test facility.

### 4.4 INSPECTION TESTS

4.4.1 MECHANICAL TESTS. - Each Motor-Alternator Set is given a thorough mechanical and visual inspection to verify conformance to the physical requirements of this specification. Particular attention is given to the following:

a. Identification markings
b. Ease of operation of switches and other controls
c. Quality of workmanship on parts, materials, and finishes.

4.4.2 ELECTRICAL TESTS. - Each Motor-Alternator Set is given all the electrical tests necessary to verify that the electrical circuits are properly wired, exhibit continuity, and conform to the specified requirements.

4.5 PERFORMANCE TESTS. - Each Motor-Alternator Set is given all the performance tests necessary to verify conformance with the applicable portions of this specification.

4.6 ACCEPTANCE TESTS. - Acceptance tests are performed by RW Division to verify compliance with the applicable portions of this specification.

5. PREPARATION FOR DELIVERY

5.1 Each Motor-Alternator Set is packed in a manner that will insure acceptance by domestic common carrier and safe delivery at destination. Shipping containers will comply with the Consolidated Freight Classification rules, or regulations of other carriers as applicable to the mode of transportation.

6. NOTES. - None.