

DATA SET 402D-TYPE RECEIVER DESCRIPTION AND OPERATION

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1. GENERAL

1.01 This section includes description and operation information on Data Set (DS) 402D-type. It does not contain operating information for the business machine associated with the data set.

1.02 This section is reissued:

- To add information on the use of DS 402D-type with Key Telephone Systems
- To comply with present format
- To provide a functional description.

Since this is a general revision, change arrows have been omitted.

1.03 DS 402D3 and D4 provide the same features as their counterparts, DS 402D1 and D2, and provide an additional feature which makes possible their alternate use with a TOUCH-TONE® telephone that functions as a data transmitter. Information pertaining to DS 402D1 and D2, which have been Manufacture Discontinued, will be retained since many of these data sets are used in the field.

1.04 DS 402D-type is the receiver component of the 402 Data System and receives signals from a 402A or 402C transmitter. It provides eight parallel binary channels for data transmission. The range of frequencies is shown in Table A. A ninth channel is provided for timing information which allows asynchronous operation at any speed up to 75 characters per second.

1.05 DS 402D-type is designed primarily for use on the switched telephone network; however, it can be used on private lines. It is installed with a DS 402C-type when a transmit-receive terminal is desired and with Data Auxiliary Set (DAS) 804A-type for a receive-only terminal. Keys on the DAS 804A or DS 402C are used for attended control of the station.

1.06 Refer to sections on DS 402C-type for information concerning the transmitter and sections on DAS 804A-type for information concerning the attendant station.

**TABLE A
FREQUENCY RANGE—DATA CHANNELS**

CHANNEL		1	2	3	4	TIMING	5	6	7	8
Freq Hz	Mark	730	900	1070	1240	1410	1580	1750	1920	2090
	Space	800	970	1140	1310	1480	1650	1820	1990	2160

1.07 DS 402D-type is capable of the following:

- (a) Receiving 8-channel parallel data and timing information.
- (b) Transmitting one of four answer-back signals to the transmitting data set. Data transmission must be interrupted when answer-back transmission is desired.
- (c) Transmitting a reverse-channel signal to the transmitting data set during data transmission (optional).
- (d) Attended or unattended operation.
- (e) Loop-back testing.
- (f) Operating with an automatic calling unit.
- (g) May be used in systems with key telephone units.

2. PHYSICAL DESCRIPTION

2.01 DS 402D-type is housed in a gray aluminum housing with a white and light gray striped aluminum front panel (Fig. 1). The overall dimensions of the data set are 17-1/2 inches wide, 7-3/4 inches high, and 11-5/8 inches deep. The data set weighs approximately 45 pounds and operates on 105 to 125 volts 60 \pm 1 Hz ac.

2.02 DS 402D-type is designed to operate properly within the ranges of the environmental conditions given below:

- Ambient temperature range of +40° to +120° F
- Relative humidity range of 20% to 95%

2.03 Two cords are supplied with the data set:

- (a) D50C-61, 5-1/2 foot mounting cord
- (b) KS-14532-L16, 10-foot, 3-conductor power cord.

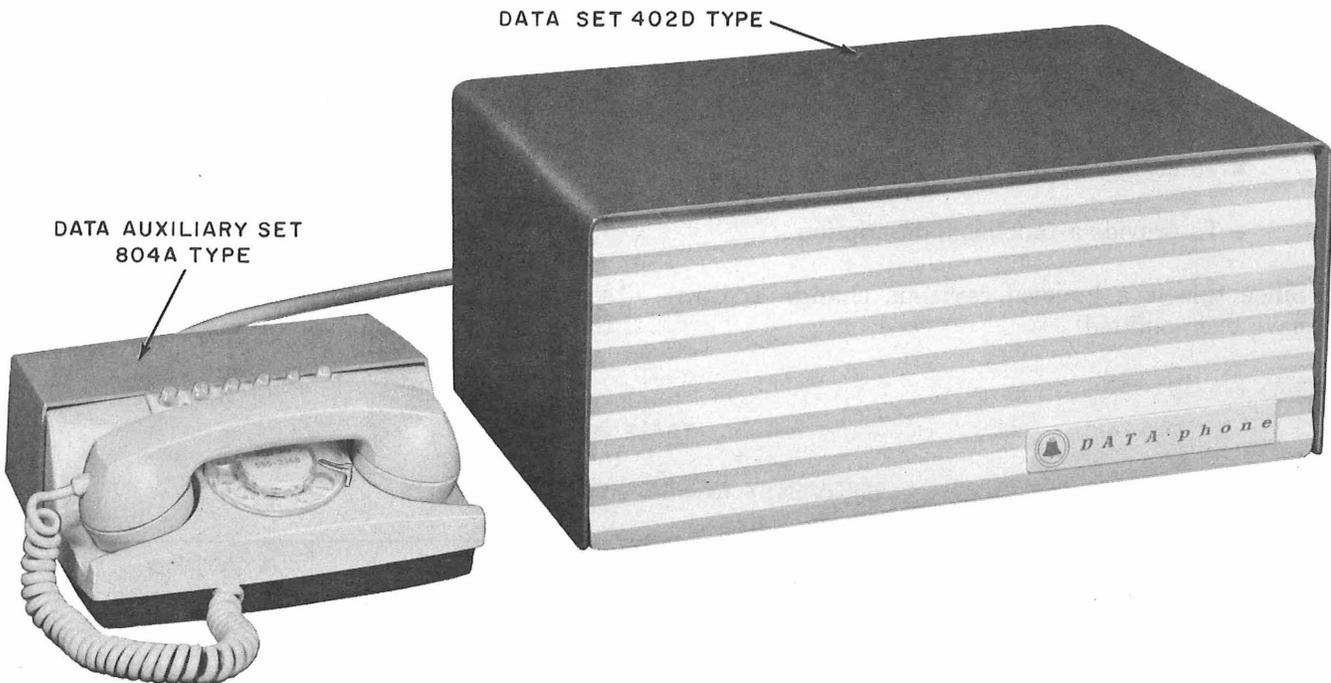


Fig. 1—Data Set 402D-Type With Data Auxiliary Set 804A—Front View

2.04 The customer must furnish the cord for connecting the business machine to the data set. The cord should be equipped with a Cinch DB 19604-432 plug or equivalent. A KS-19087-L2 receptacle for this connection is located at the rear of the data set (Fig. 2).

2.05 Cover removal and replacement procedures for DS 402D-type are described in the section

entitled Data Set 402D-Type Receiver—Maintenance (594-020-300).

3. FUNCTIONAL DESCRIPTION

3.01 This part describes the major functional components that make up DS 402D-type. Refer to Fig. 3 for a simplified block diagram of the data set. DS 402D2 and 402D4 contain a reverse-channel transmitter in addition to all of the items contained in DS 402D1 and 402D3.

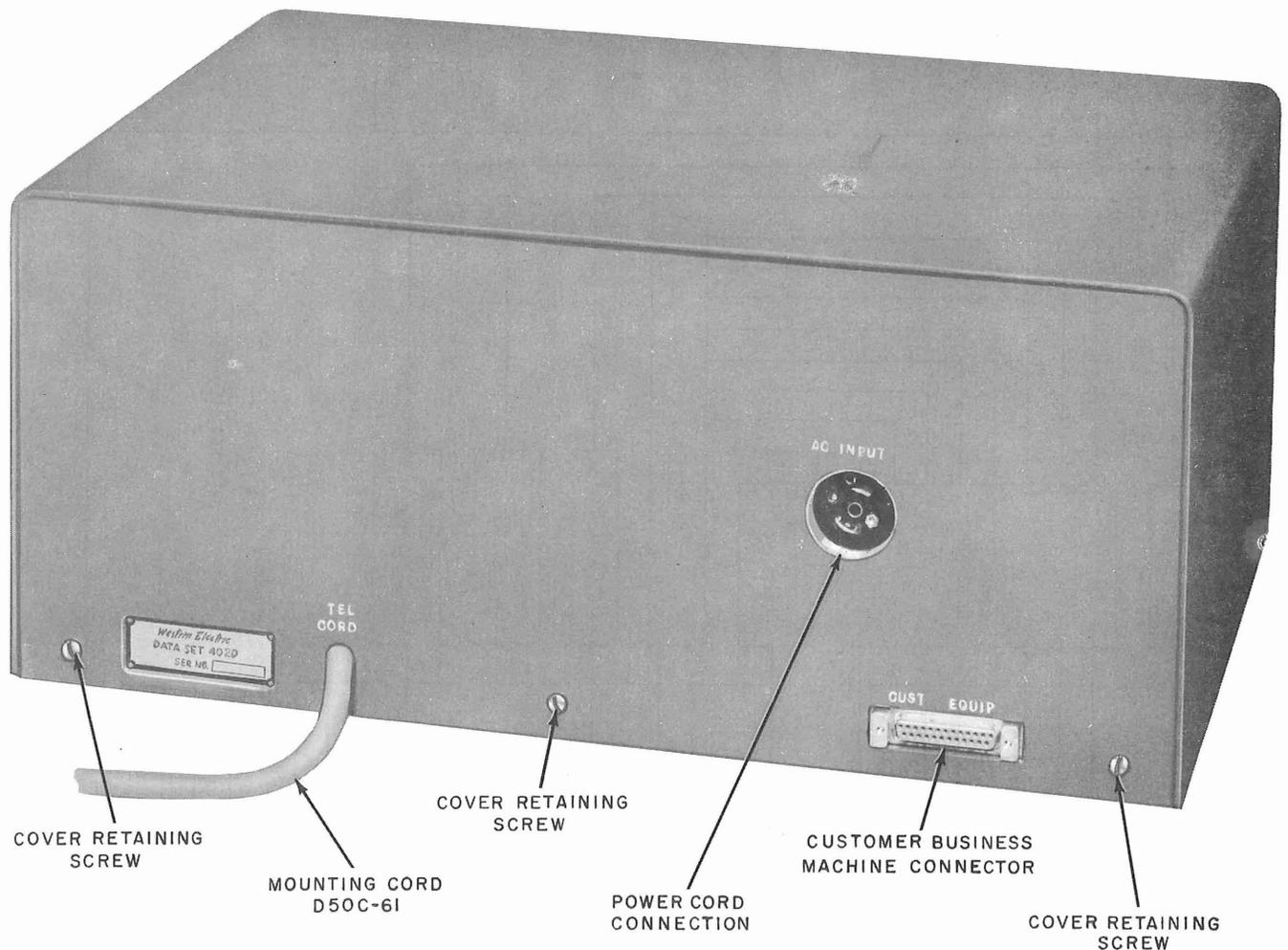
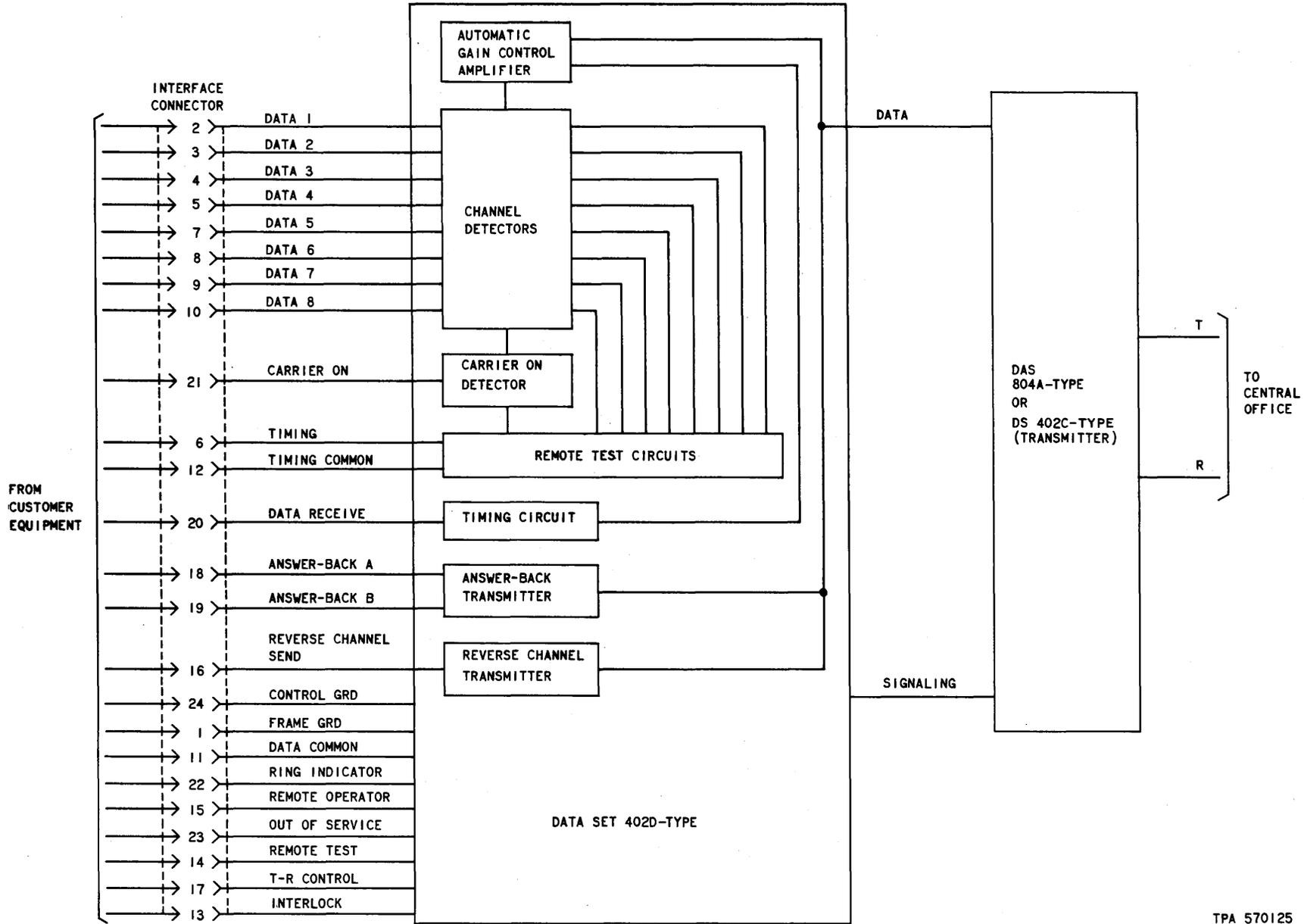


Fig. 2—Data Set 402D-Type—Rear View



TPA 570125

Fig. 3—Data Set 402D-Type—Functional Block Diagram

3.02 DS 402D-type consists of:

- Automatic gain control amplifier
- Timing circuits
- Eight channel detectors
- Answer-back transmitter
- Carrier-on detector
- Remote test circuit
- Power supply
- Reverse-channel transmitter (402D2 and D4 only).

3.03 The automatic gain control (AGC) circuit amplifies the input signal to the receiver to a fixed level before the signal reaches the data detectors. This AGC action compensates for the variation in received signal levels resulting from variations of different paths through the switched telephone network.

3.04 The eight channel detectors are each tuned to a band of frequencies which includes the mark and space frequency of the channel of interest (see Table A). The detector circuits demodulate the data signal to provide an indication to the business machine that a mark or a space frequency is being received. A contact closure to the business machine indicates a data mark frequency has been received and the absence of a contact closure indicates a space frequency has been received by the data set.

3.05 The carrier-on detector determines whether valid data is being received by monitoring the receipt of the 40-msec all-space code, and provides a contact closure to the business machine when valid data is recognized.

3.06 The remote test circuits allow the data set to be statically and dynamically tested from a remote data test center. Control of the remote test mode is provided by a key on the associated DS 402C or DAS 804A. In the static test, the data test center transmits a data character and DS 402D acknowledges receipt of the character by returning one of four answer-back tones in Table

B. The answer-back tone transmitted depends on the data character sent to the data set from a DTC. When the remote test circuits are in the dynamic test mode, a dotting pattern is sent to the data set on all channels. The data set will send an answer-back signal in response to any errors which are generated in any of the data channels. Receiver sensitivity, tolerance to skew and jitter, and operation of the carrier-on detector may also be checked in the dynamic test mode.

TABLE B

REMOTE TEST ANSWER-BACK FREQUENCIES

MARKING CHANNEL	ANSWER-BACK FREQUENCY (Hz)
1	1017
2	1785
3	1152
4	2025
5	1017
6	1785
7	1152 and 387
8	2025

3.07 The timing circuit presents a signal to the business machine indicating that a data character is present on the data leads. The timing (sync) signal is alternately marking and spacing and the transition from mark to space or space to mark results in a signal to the customer that a new data character is being received.

3.08 The answer-back transmitter is used for signaling from DS 402D-type to its associated transmitter. Four frequencies (Table C) are available and the circuit may be keyed at a maximum signaling rate of 40 baud. Answer-back signaling can only be accomplished when data is not being received by DS 402D-type.

3.09 The reverse-channel transmitter can be optionally provided in DS 402D2 or D4. The reverse-channel signal, at a frequency of 387 Hz, is transmitted at the same time data is being received or answer-back is being sent. This feature is normally used to provide circuit assurance or it may be used to signal by interrupting the RC signal.

TABLE C
FREQUENCIES

ANSWER-BACK AND REVERSE CHANNEL CIRCUITS

DESIGNATION	FREQUENCY Hz
Answer-Back A	1017
Answer-Back B	2025
Answer-Back AB	1785
Rest Tone	1152
Reverse-Channel	387

4. OPERATION

4.01 The DS 402D-type is designed to be installed with DAS 804A or DS 402C (transmitter). The keys on the 804A or 402C sets are used for attended control of the station and are designated TALK, DATA, and TEST.

4.02 To Originate a Data Call:

(1) Depress TALK key (TALK lamp lights), lift handset (TALK lamp lights), and establish connection with the distant terminal in the normal telephone manner.

(a) **Manually:** After distant terminal has answered, verbal agreement is reached as to when data is to be sent. Depress the DATA key until its associated lamp lights, then release.

(b) **Automatically:** 2025-Hz tone should be heard for a few seconds, indicating the distant set is ready to receive data. Depress DATA key until its associated lamp lights, then release.

(2) Releasing the DATA key restores the TALK key to normal and extinguishes the TALK lamp. The set is now in the data mode and transmission can begin. The handset should be placed on its cradle. In this condition, accidental operation of any key will not affect data transmission.

4.03 To terminate a call, depress the TALK key, lift the handset from its cradle, then hang up.

4.04 The data set may also be conditioned to answer incoming calls manually or automatically.

(a) **Manual Answer:** Call is answered in normal manner with TALK key depressed. When verbal agreement is reached concerning when transmission is to begin, depress DATA key until DATA lamp lights. Releasing the DATA key restores the TALK key to normal and extinguishes the TALK lamp. The set is now in the data mode and transmission can begin. Handset should be placed on cradle to preclude interruption of data transmission.

(b) **Automatic Answer (Option N):** Data sets conditioned for automatic answer require no operation by the attendant. After transmitting the answer tone, the station goes into the data mode independent of the position of the keys.

4.05 Test Mode:

(a) **To Place Data Set in Test Mode:**

(1) Remove handset from cradle and depress TALK key. TALK lamp lights.

(2) Depress and release nonlocking TEST key (TEST lamp lights). Data set is now in test mode. Handset may be placed on cradle.

(b) **Manual Release of Data Set From Test Mode:**

(1) Remove handset from cradle.

(2) Depress and release the nonlocking DATA key.

(3) Depress the TALK key and replace handset on cradle.

(c) The test mode is also released by interruption of power.

4.06 Interface lead functions are shown in Table D.

TABLE D
INTERFACE LEAD FUNCTIONS

PIN NO.	LEAD	FUNCTION
1	Frame Ground	Common to signal and ac power service ground.
2	Data 1	Indicates whether corresponding channel is mark (closed) or space (open).
3	Data 2	
4	Data 3	
5	Data 4	
6	Timing	Closes to timing common for 5 msec for each character.
7	Data 5	Indicates whether corresponding channel is mark (closed) or space (open).
8	Data 6	
9	Data 7	
10	Data 8	
11	Data Common	Common lead for closing data leads.
12	Timing Common	Common lead for closing timing lead.
13	Interlock	Signals business machine when data set is data mode.
14	Remote Release	Opened from control ground by customer to terminate call.
15	Remote Operate	Closed to control ground by customer for unattended answer feature.
16	Reverse-Channel Send	Closed to control ground by customer to cause reverse-channel to transmit (option).
17	T-R Control	Controls transmit or receive condition at transmit-receive terminals.
18	Answer-Back A	Operated to transmit corresponding answer-back.
19	Answer-Back B	
20	Data Receive	Grounded by customer to receive data, opened to transmit answer-back.
21	Carrier On	Closes to data common to indicate a signal is being received from a 402-type transmitter.
22	Ring Indicator	Indicates presence of ringing current to business machine on incoming call.
23	Out-of-Service	Enables line to be made busy when equipment is out of service.
24	Control Ground	Common with frame ground.
25		Not used.

SECTION 594-020-100

5. REFERENCES

5.01 For additional information relating to DS 402D-type, refer to the following documents:

SECTION	TITLE	SECTION	TITLE
		594-020-500	Data Set 402D-Type Receiver— Test Procedures
SD&CD-1D040-01	Data Systems Station—Data Set 402D-Type Receiver Circuit	590-004-105	Data Set 402D-Type—Reference Guide
594-020-200	Data Set 402D-Type Receiver— Installation And Connections	668-104-523	Data Test Center 904A and 904C-Type Test Procedure—Data Set 402D-Type Loop Back Test
594-020-300	Data Set 402D-Type Receiver— Maintenance		