

FEMCO DIVISION  
GULTON INDUSTRIES, INC.

MAINTENANCE MANUAL  
FOR  
PERMISSIBLE TALKBACK LOUDSPEAKING MINE TELEPHONE  
821301/303  
AM7022

DO NOT CHANGE WITHOUT APPROVAL OF  
MINE SAFETY AND HEALTH ADMINISTRATION

Copyright Gulton Industries, Inc., 1983

821301-02.8  
JUNE 1983

TABLE OF CONTENTS

	Page
SECTION 1 - GENERAL DESCRIPTION -----	1/1
Introduction -----	1/1
Specifications -----	1/1 , 2
Permissible System -----	1/2
Installation -----	1/3
Block Diagram 821301/303 AM7022 -----	1/4
SECTION 2 - CIRCUIT ANALYSIS -----	2/1
Introduction -----	2/1
Block Diagram -----	2/2
Circuit Description -----	2/3
Schematic - Permissible Talkback Loudspeaking Mine Telephone 821301/303 AM7022 -----	2/4
SECTION 3 - MAINTENANCE -----	3/1
Introduction -----	3/1
Troubleshooting Charts -----	3/2
SECTION 4 - PARTS IDENTIFICATION -----	4/1
Introduction -----	4/1
General Assembly - 821301/303 Permissible Talkback Loudspeaking Mine Telephone -----	4/2
Assembly - WBA4097 - Permissible Loudspeaking Mine Telephone Printed Circuit Board -----	4/3
Assembly List - WBA4097 - Permissible Loudspeaking Mine Telephone Printed Circuit Board -----	4/4
Assembly - WBA4155 - Talkback Pre-amplifier Printed Circuit Board -----	4/5

SECTION 1

GENERAL DESCRIPTION

INTRODUCTION

The Permissible Talkback Loudspeaking Mine Telephone, AM7022 is designed to be used in mines where permissible devices must be used, as specified by mining laws. Two 12VDC batteries are used during the transmitting operation to produce the required 12VDC keying voltage on the phone lines. Provisions are made to keep the unit's speaker quiet when transmitting a normal audio signal. Input phone line DC polarity does not have to be observed since the unit's design provides for polarity reversal. A volume control is provided for the speaker. This unit offers higher impedance for both AC and DC operation than other models and allows many units to operate on the same phone lines. A spring loaded switch is provided for paging. Conversation is transmitted by placing the spring return page switch in the page position and talking directly into the speaker and releasing the page switch to listen.

SPECIFICATIONS

The electrical, mechanical and environmental specifications for the unit are as follows:

ELECTRICAL

Power Source -----	Two 12VDC NEDA 926 batteries or equiv.
Battery Requirements -----	a. Standby - 0`milliamperes b. Speaker Amplifier- 28 milliamperes at standby and 250 milliamperes for peak operation.
Phone Line -----	17K ohms DC, 4.5K ohms @ 1 KHZ. (Allows operation of many units on the same phone lines.)
Paging Voltage -----	12 VDC
Paging Sensitivity -----	Solid State - pick up at 2.5 VDC or greater, drop out at 2.0 VDC.
Paging Switch -----	Bat handle
Speaker -----	3 watt, 8 ohm, 4" water-proof cone

Controls ----- a. Speaker Amplifier R15 adjustable  
to 30 dB.

Output Power ----- a. Speaker Amplifier - maximum of 2 watts  
into 8 ohms (clipped).

Short Circuit Paging  
Current ----- 0.35 amperes

Insulation ----- 600 VDC between line and ground.

Carrier Impedance ----- a. Line-to-line - 7K ohms.  
b. Line-to-ground - 100K ohms.

MECHANICAL:

Dimensions ----- 6.68"width, 15.41" H, 5.00" depth

Weight ----- 15 lbs. 8 oz. with batteries

Construction ----- 18 gauge stainless steel

Connections ----- Spring loaded push terminals for  
phone line (2)

ENVIRONMENTAL:

Moisture Resistance ----- 0 to 95% humidity with printed circuit  
board conformal coated.

Temperature Range ----- -30°C to +60°C.

PERMISSIBLE SYSTEM

For a system to be permissible, all phones connected to the  
same phone line must be permissible units.

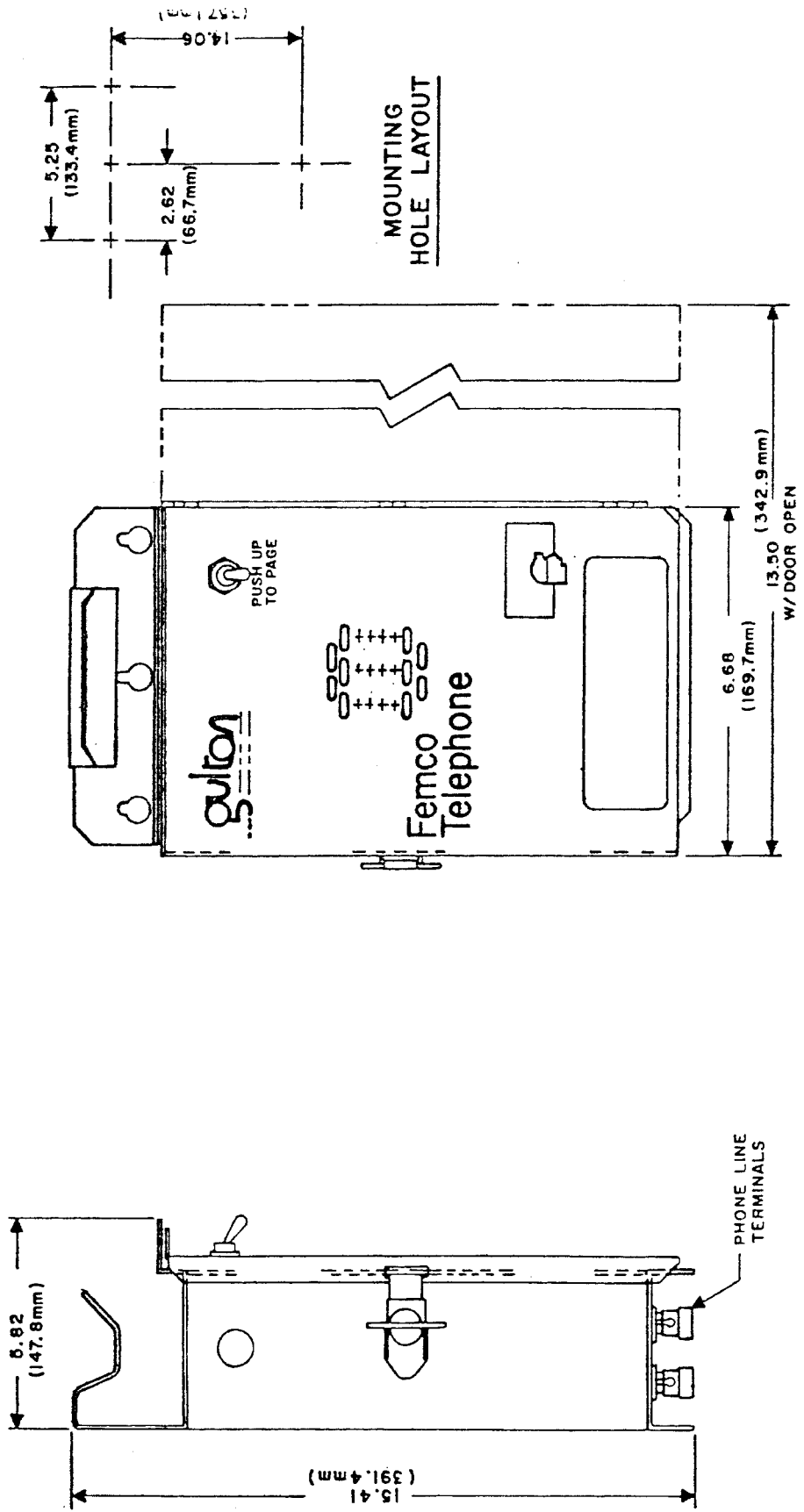
## INSTALLATION

One (1) 1/4 mounting slot is provided in the bottom center of the back plate and three (3) key punched holes are provided at the top of the back plate for mounting the unit to a wall, pole, desk or other similar structure.

Install batteries and properly make all connections.

A fused station protector, FU2590, should be installed approximately every two miles on the phone line to protect against high voltage transients to ground.

WARNING: THIS TELEPHONE MUST NOT BE CONNECTED TO A NON-PERMISSIBLE TELEPHONE OR TO A PERMISSIBLE TELEPHONE DESIGNED TO OPERATE OR PAGE AT VOLTAGES OTHER THAN 12 VDC.



OUTLINE AND MOUNTING DIMENSIONS-PERMISSIBLE TALKBACK  
 MINE TELEPHONE 821301/303 AM7022

Section 2  
CIRCUIT ANALYSIS

INTRODUCTION

This section of the manual is provided for acquainting maintenance personnel with the circuit operation of the unit. A block diagram is discussed to show the general operation of the unit. In addition, the schematic diagram is shown in order to explain the operation of the various components that comprise the unit.

BLOCK DIAGRAM

Refer to Figure 2-1. Section A discusses the unit operation when receiving a page. A DC voltage is imposed on the phone line by the paging party from a distant unit. This is full wave bridge rectified which handles any polarity reversal on the phone line. The rectified DC voltage allows Q2 to conduct which in turn, allows Q3 to conduct. When Q3 conducts, it allows IC1 to operate and amplify the audio signal. The audio signal is transformer coupled through T1 and amplified by IC1 before passing to the speaker. The volume is adjusted by the SPEAKER VOLUME CONTROL.

Section B discusses the unit operation when paging another operator or when transmitting during normal conversation. The 12VDC keying voltage is applied to the phone lines via S1. The speaker is disconnected from receiving amplifier and cut off. The audio signal from the speaker is amplified by the talkback amplifier then fed to the input of the transmitting amplifier IC2.

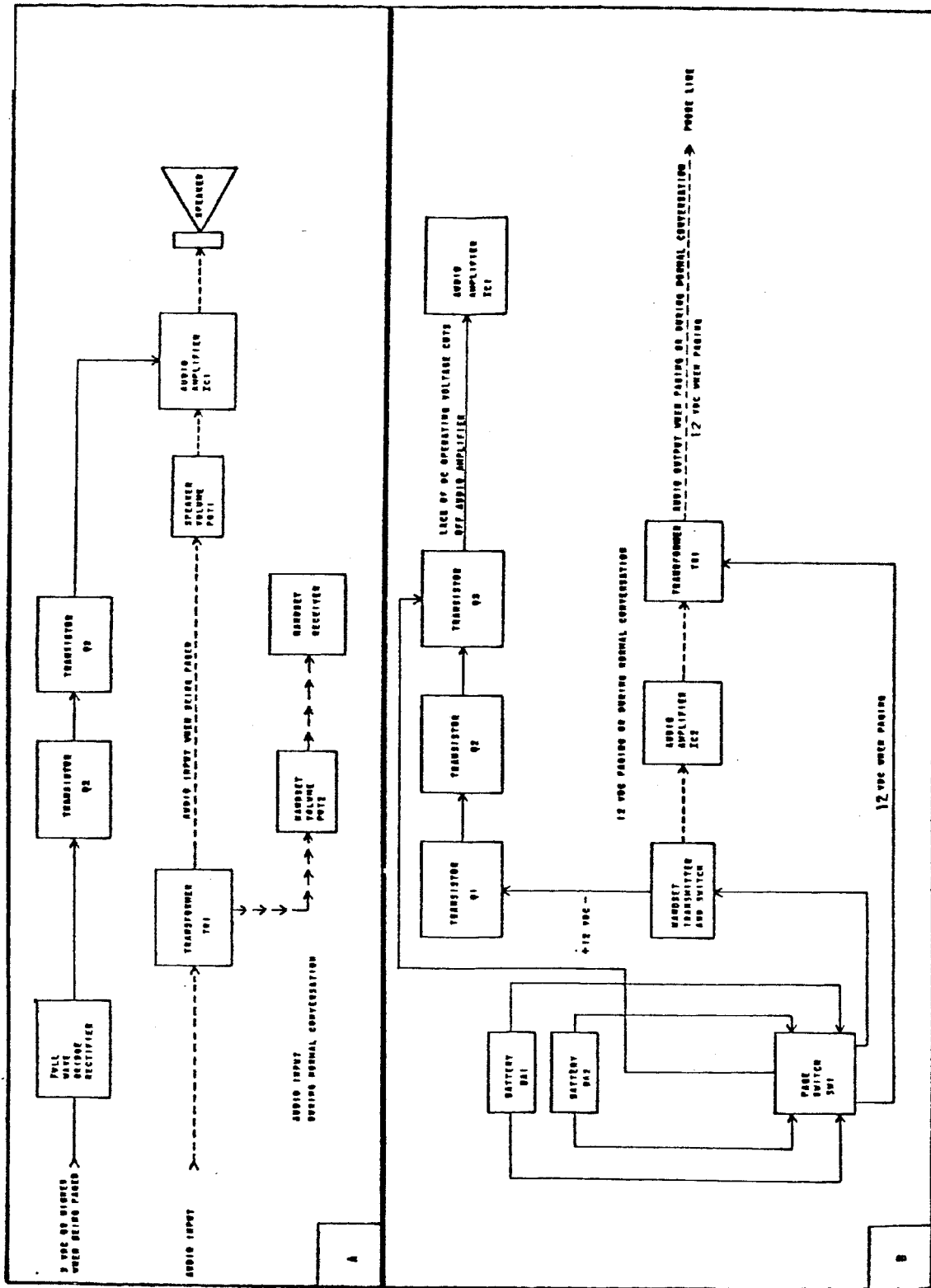


Figure 2-1 - Block Diagram of Permissible Talkback Loudspeaking Mine Telephone 821301/303 AM7022



## CIRCUIT DESCRIPTION

Refer to Figure 2-2. This is a schematic diagram of the unit. When the unit is being paged by another operator on the line, and when receiving a message during normal conversation, a DC voltage is imposed across terminals 8 and 9. Polarity does not have to be observed since diodes CR1 thru CR4 comprise a full wave rectifier that sets the correct polarity. Positive is applied to the base of transistor Q2 which allows it to conduct. When Q2 conducts, transistor Q3 goes into conduction, which in turn, allows the audio amplifier IC1 to operate. The audio signal is applied across the secondary of transformer T1 and transformer coupled to the primary. It then passes through R15, the speaker volume control, to be amplified by IC1. The amplified audio signal is now passed to the speaker.

When transmitting the page switch, S1, is placed in the PAGE position. This places a DC voltage at the base of transistor Q1, allowing it to conduct. When Q1 conducts, Q2 is cut off which, in turn, cuts off Q3. When Q3 is cut off it prevents IC1 from operating. No audio signal can reach the speaker at this time. The audio signal from the speaker is amplified by the talk back amplifier, then fed to the transmitting amplifier IC2 and transformer coupled by T1 to the phone lines.

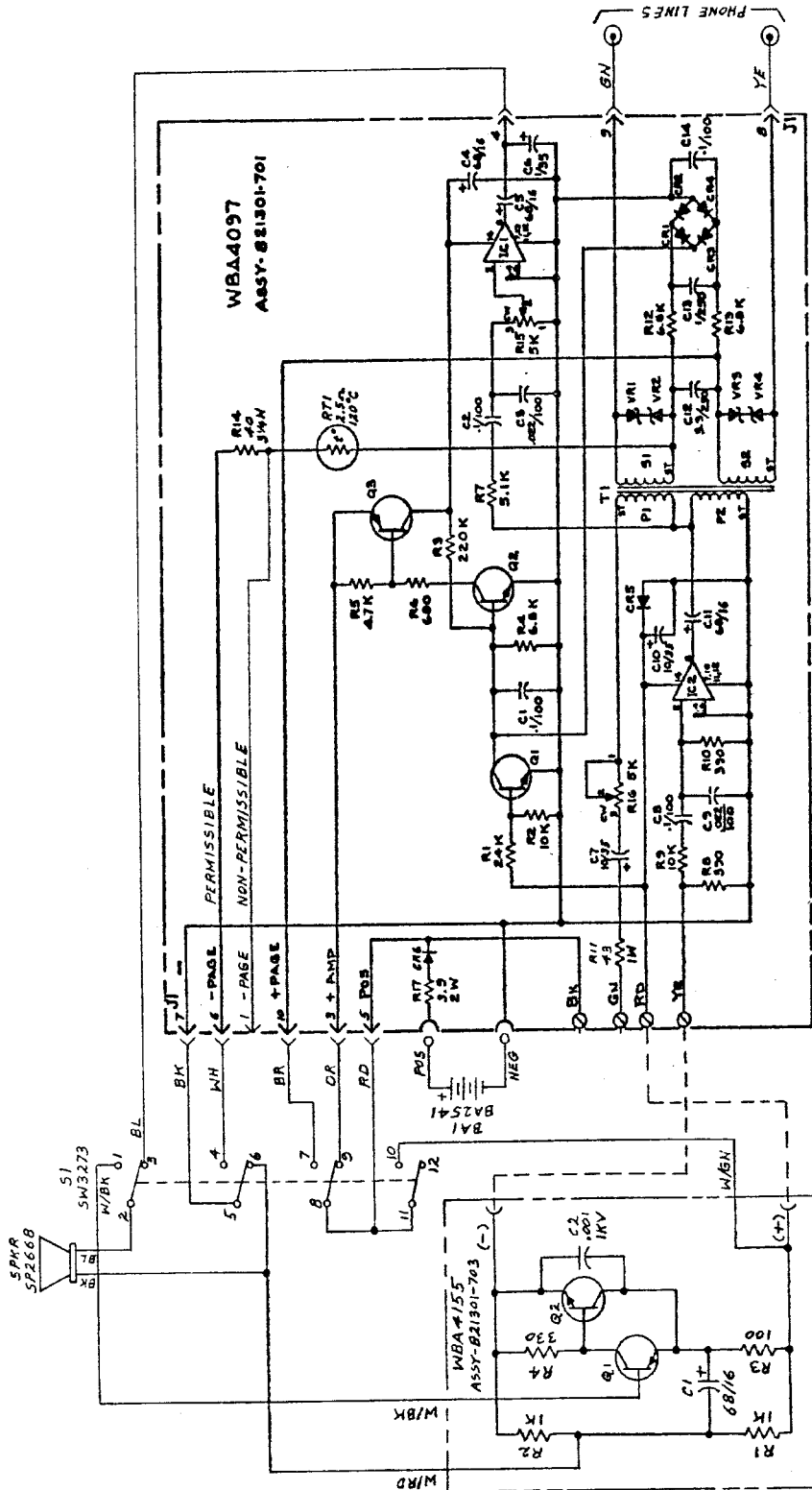


FIGURE 2-2 SCHEMATIC OF PERMISSIBLE TALKBACK LOUDSPEAKING MINE TELEPHONE 821301/303 AM7022

SECTION 3  
MAINTENANCE

INTRODUCTION

This section of the manual contains information pertaining to the maintenance of the unit. Troubleshooting charts are provided to help in localizing the problem areas. Before any serious maintenance is considered, however, replace the battery to insure the correct operating voltage.

TROUBLESHOOTING CHARTS

The following troubleshooting charts are provided to assist maintenance personnel in localizing the general problem areas. Each chart contains three columns which are Symptom, Probable Cause and Remedy.

SYMPTOM	PROBABLE CAUSE	REMEDY
When receiving a page, phone lines are keyed by 12 VDC but there is no operating DC voltage for transistor Q2.	Diode CR1 and/or CR2, CR3, CR4 is defective.	Replace diode CR1 and/or CR2, CR3, CR4.
DC operating voltage OK but when receiving a page, or when receiving a normal message, audio does not reach speaker.	Transistor Q2 is defective.	Replace transistor Q2.
	Transistor Q3 is defective.	Replace transistor Q3.
	Integrated circuit IC1 is defective.	Replace integrated circuit IC1.
	The speaker volume control (R15) is misadjusted.	Re-adjust the speaker volume control (R15).
	Transformer T1 is defective.	Replace transformer T1.

SYMPTOM	PROBABLE CAUSE	REMEDY
When paging another party, correct 12VDC is not imposed on phone lines.	Batteries BA1 and BA2 are weak or defective	Replace batteries BA1 and BA2
	The PAGE switch, SW1 is defective.	Replace PAGE switch.
When paging another party or transmitting during normal conversation, no audio signal is produced.	Transmitting element in handset is defective.	Replace transmitting element in handset.
	Integrated circuit IC2 is defective.	Replace integrated circuit IC2.
	Transformer T1 is defective.	Replace transformer T1.

## SECTION 4

### PARTS IDENTIFICATION

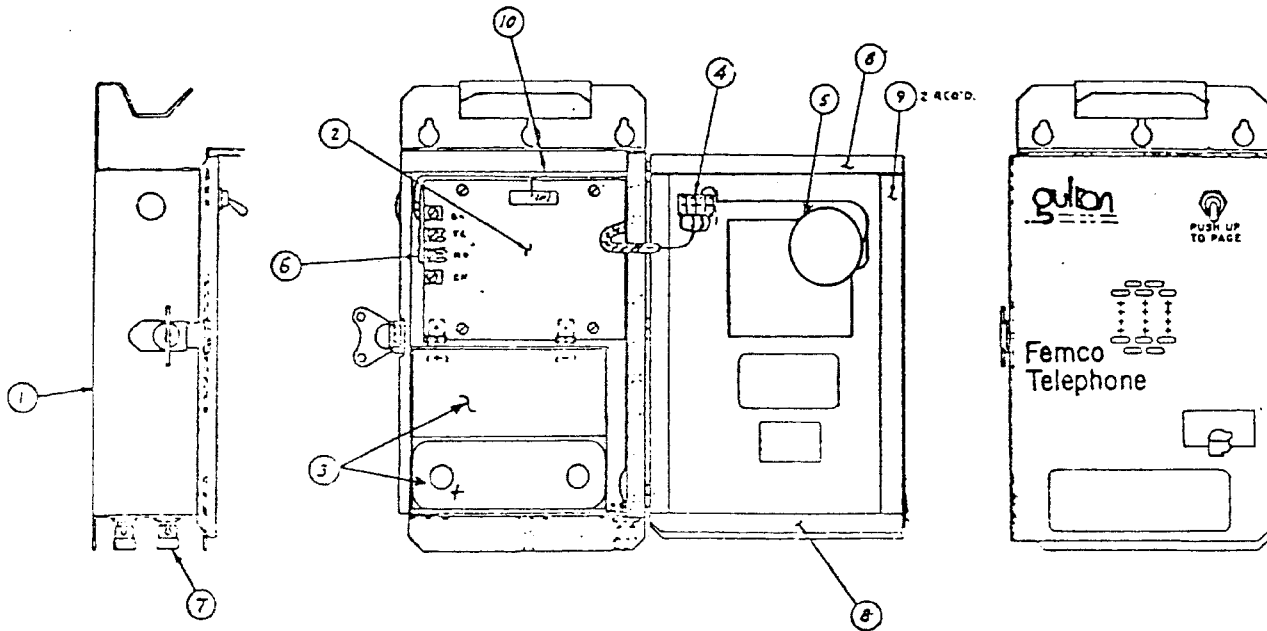
#### INTRODUCTION

The following information is presented to acquaint maintenance personnel with the procedure required for identifying parts. Normally, the parts identification is initiated by a breakdown of the major assemblies. The sub-assemblies, that comprise the individual major assemblies, are then reduced to their component parts. Each component part is identified by a circuit symbol, description and associated part number. Assembly and sub-assembly drawings are provided to facilitate in the part identification. In addition, reference can be made to the schematic in Section 2 of the manual if further identification is required.

For information on ordering parts, it is best to contact the local sales office to obtain the most current and expedient procedure.

GENERAL ASSEMBLY: 821301/303 AM7022 Permissible Talkback  
Loudspeaking Mine Telephone

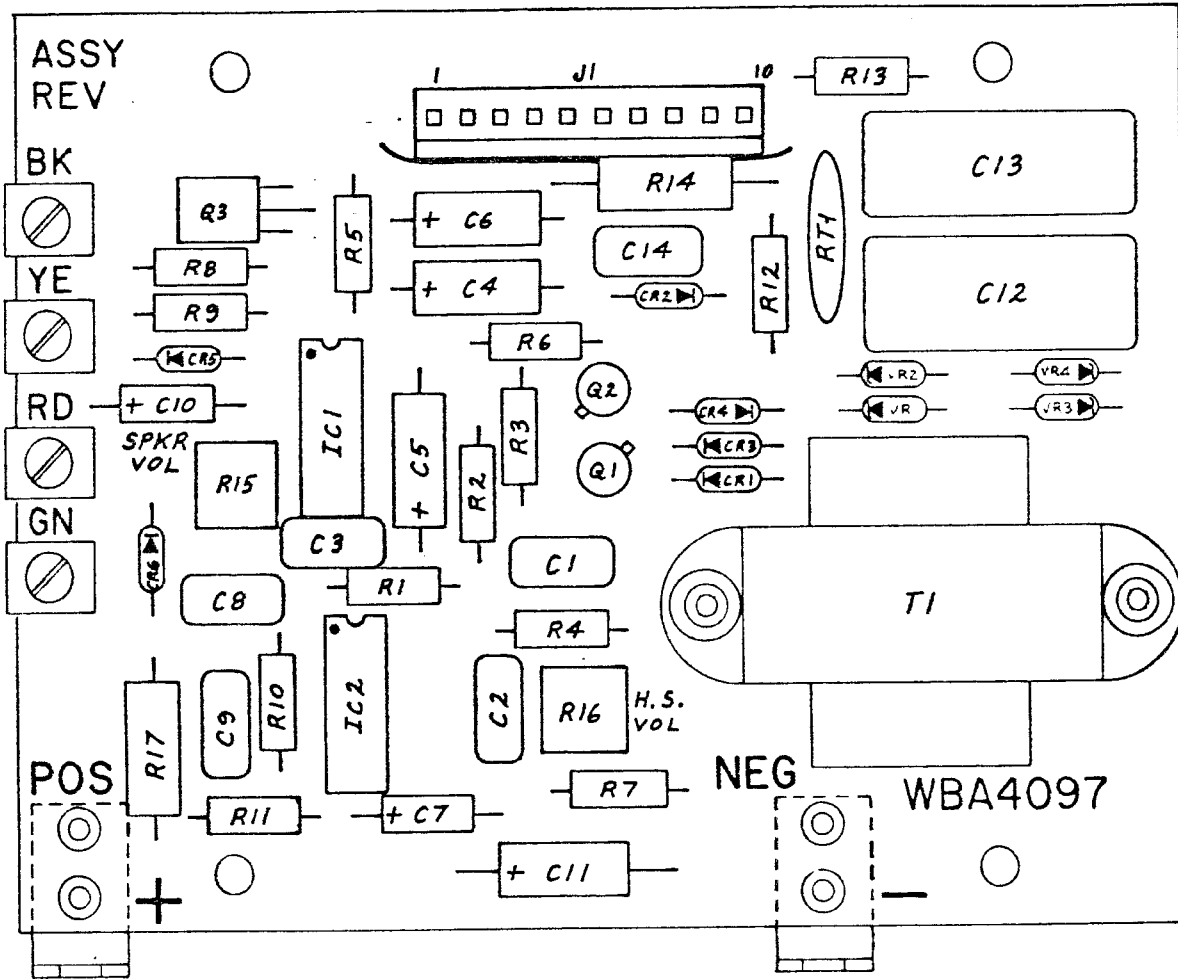
Ref. Dwg: 821301-305, 821301-03.2



ITEM	PART NO.	DESCRIPTION
1	BA4721	Housing
2	WBA4097	Printed Circuit Board
3	BA2541	Battery (2 required)
4	SW3273	Switch
5	SP2668	Speaker
6	WBA4155	Talkback Preamp Board
7	TE2780	Binding Post
8	MC3589	Gasket 6-9/16"
9	MC3589	Gasket 11-3/4"
10	HA4024	Wiring Harness

ASSEMBLY: WBA4097 Permissible Loudspeaking Mine Telephone  
 Printed Circuit Board

Ref. Dwg: 821301-701



ASSEMBLY LIST-WBA4097 PERMISSIBLE LOUDSPEAKING MINE TELEPHONE  
PRINTED CIRCUIT BOARD

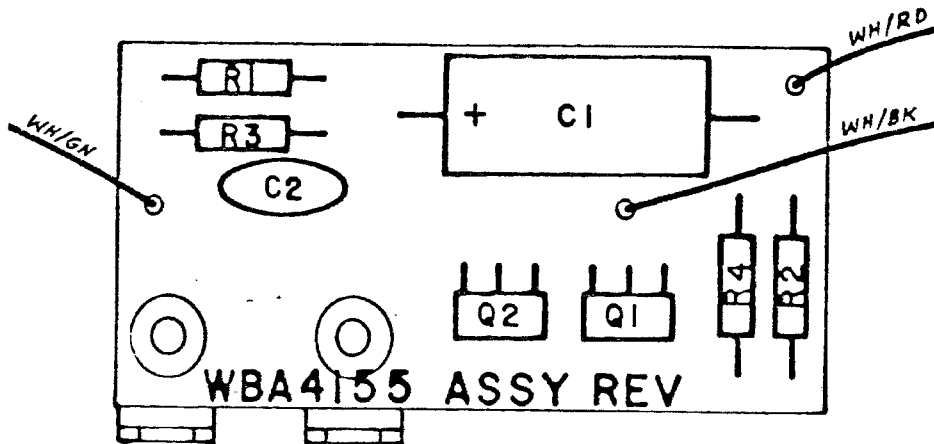
Ref. Dwg: 821301-801

CIRCUIT SYMBOL	PART NUMBER	VALUE
<u>Resistors</u>		
R1	RE24325	24K
R2,9	RE10325	10K
R3	RE22425	220K
R4,12,13	RE68225	6.8K
R5	RE47225	4.7K
R6	RE68125	680 ohm
R7	RE51225	5.1K
R8,10	RE39125	390 ohm
R11	RE3677	43, 1W, WW
R14	RE3551	40, 3 1/4W, WW
R15,16	RE3369	5K potentiometers
R17	RE3678	3.9, 2W, fusible
All resistors 1/2 W unless otherwise noted.		
<u>Capacitors</u>		
C1,2,8,14	CD3752	.1 uf, 100V
C3,9	CD3744	.022 uf, 100V
C4,5,11	CD3380	68uf, 16V
C6	CD3315	1 uf, 35V
C7, 10	CD3351	10 uf, 35V
C12	CD7036	3.3 uf, 250V
C13	CD7037	1 uf, 250V
<u>Diodes</u>		
CR1-5	TU2500	Silicon diodes
VR1-4	TU2692	Zener diodes
CR6	TU2685	Silicon diode
<u>Transistors</u>		
Q1,2	TU2750	Transistors
Q3	TU2604	Transistor
<u>Integrated Circuits</u>		
IC1,2	TU2605	Integrated Circuits
<u>Transformer</u>		
T1	TR3031	Transformer
<u>Miscellaneous</u>		
J1	CN3827	Connector
	MO4363	Battery Brackets
	NU2630	Screw Clips
<u>Thermistor</u>		
RT1	RE3676	2.5 ohm



ASSEMBLY-WBA4155 Talkback Pre-amplifier Printed Circuit Board

Reference Drawings: 821301-703, 821301-803



CIRCUIT SYMBOL	PART NUMBER	VALUE
<u>Resistors</u>		
R1,2	RE10271	1K, 1/4W, +5%
R3	RE10171	100, 1/4W, +5%
R4	RE33171	330, 1/4W, +5%
<u>Capacitors</u>		
C1	CD3380	68 uf, 16V
C2	CD3551	.001 uf, 1KV
<u>Transistors</u>		
Q1	TU2768	2N3905 Transistor
Q3	TU2766	2N3903 Transistor
<u>Miscellaneous</u>		
	TE3155	Terminal Bracket
	RI2506	Eyelet
	WI2641M	Wire, 20 AWG, WH/BK
	WI2641P	Wire, 20 AWG, WH/RD
	WI2641R	Wire, 20 AWG, WH/GN

TECHNICAL PUBLICATION ADDENDUM

PUBLICATION TITLE: Permissible Talkback Loudspeaking Mine Telephone

PUBLICATION NUMBER: 821301-02.8

EFFECTIVE DATE: NOV 1983

DESCRIPTION OF CHANGE: TC083134

Page 1/2: Added weight "15 lbs 8 oz. with batteries"

2/4: Added - PAGE NON-PERMISSIBLE lead

4/2: Changed view of Item 5

4/3: Relocated C3; added jumper from J1-1 to R14

Form with horizontal lines for additional entries.