E2A TELEMETRY ALARM PROCESSING REMOTE (APR) SYSTEM DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section contains a general description of the E2A alarm processing remote (APR) and an application of T-Carrier Administration System (TCAS). This includes a description of the equipment as well as a functional description of its operation.

1.02 The reasons for reissuing this section are listed below. Since this is a general revision, no revision arrows have been used to denote significant changes.

(a) Includes information for the application of the new J1P029A E2A alarm processing remote with polling serial ports. The original J1P029A bay will be referred to as J1P029A-L5. This configuration is no longer available. The new J1P029A bay which replaces the original configuration provides all the original features and also adds the polling serial port feature. This configuration is referred to as J1P029A-L11.

(b) Includes illustrations for E2A APR with polling serial ports bay.

1.03 The E2A APR is a microprocessor-controlled station featuring the capability to process status input data directly at the remote. Other E2A remotes already in existence, such as the E2A status and command (SAC) remote, do not have this capability; therefore, they must rely on a maintenance system central for all processing of the status information.

1.04 The E2A APR (J1P029A-L5 and the J1P029B, or C) can process a maximum of 2048 status inputs and control a maximum of 2048 remote switches. With the processing capability, E2A APR is more complex than the other E2A remotes yet is very similar in other capabilities to the E2 remote which it will eventually replace for new applications. To add to its advantages, the APR is compatible with many existing surveillance systems using E1 and E2 remotes. Therefore, it can be used to add remotes to existing centrals using E1 and E2.

1.05 The E2A APR is presently being used with the following:

- E1 alarm central
- E2 alarm central
- Surveillance and Control of Transmission Systems (SCOTS)
- Carrier Terminal Maintenance System (CTMS)
- Telecommunications Alarm Surveillance and Control (TASC) System
- T-Carrier Administration System (TCAS).

There are bay configurations to accommodate these applications. One is the J1P029A bay used for E1 and E2 centrals and the SCOTS, TASC, and TCAS. Another is the J1P029B and J1P029C bay assemblies used only for CTMS. The other is the J1P029D assembly used only in TCAS. These APR equipment bays are described in Part 2 of this section.

1.06 The E2A APR with serial data port (J1P029D) can process a maximum of 768 discrete status inputs and control a maximum of 128 remote switches. It also has the capability of monitoring three ESSs, No. 1 or No. 1A ESS equipment. Each ESS port can monitor 1024 carrier group alarms (CGAs).

1.07 The E2A APR with polling serial ports (J1P029A-L11) allows the same discrete 2048 status inputs and discrete 2048 remote switches as the J1P029A-L5. In addition, the E2A APR with polling serial data ports can have up to eight polling serial ports. Each port can connect to a single piece of equipment and may have up to 512 status inputs and remote switches. This is a total of 1792 additional status inputs and remote switches. This feature uses only two pairs of wires from each single piece of equipment.

2. EQUIPMENT DESCRIPTION

2.01 As stated in the previous paragraph, an E2A APR may be one of three bay configurations, depending on its application:

- J1P029A E2A alarm remote
- J1P029B and J1P029C assembly carrier alarm scanner (for CTMS application only)
- J1P029D used in TCAS.

These bays are basically identical. The main difference is in the circuitry of the APR common control (APRCC). A typical E2A APR bay is shown in Fig. 1.

2.02 The E2A APR (J1P029A-L5, J1P029B, or C) bay (refer to Fig. 2A) consists of the units listed in Table A. Note that there may be several of the specified units. The E2A APR with polling serial ports (J1P029A-L11) as shown in Fig. 2B consists of the units in Table B. A typical E2 APR serial data port bay (J1P029D) is shown in Fig. 3.

2.03 Two E2A telemetry remotes are used in TCAS implementations. One provides hard-wired access to carrier group alarms while the second is used with the new ESS access arrangement. The E2A APR with serial data ports bay (J1P029D) is shown in Fig. 3.

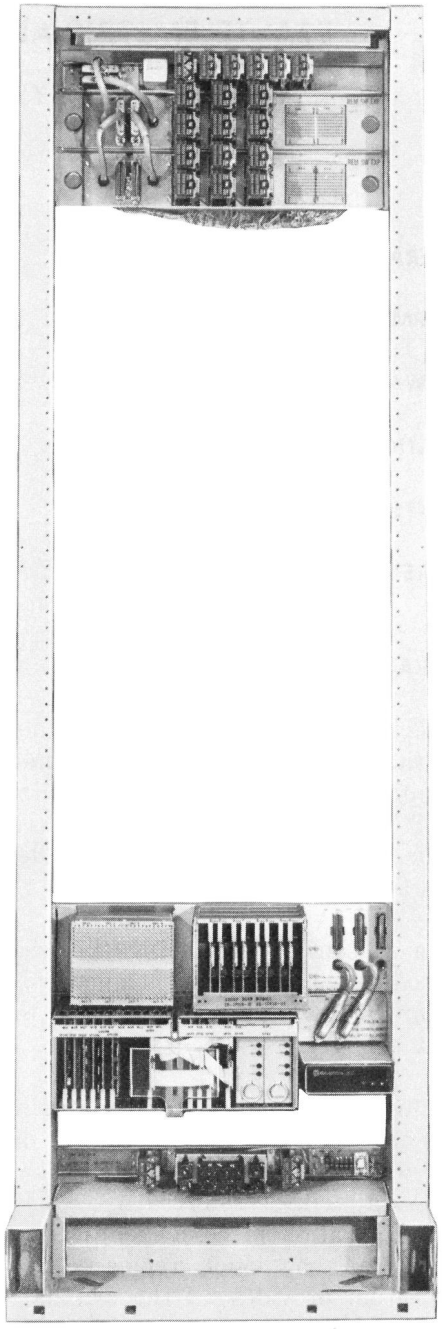
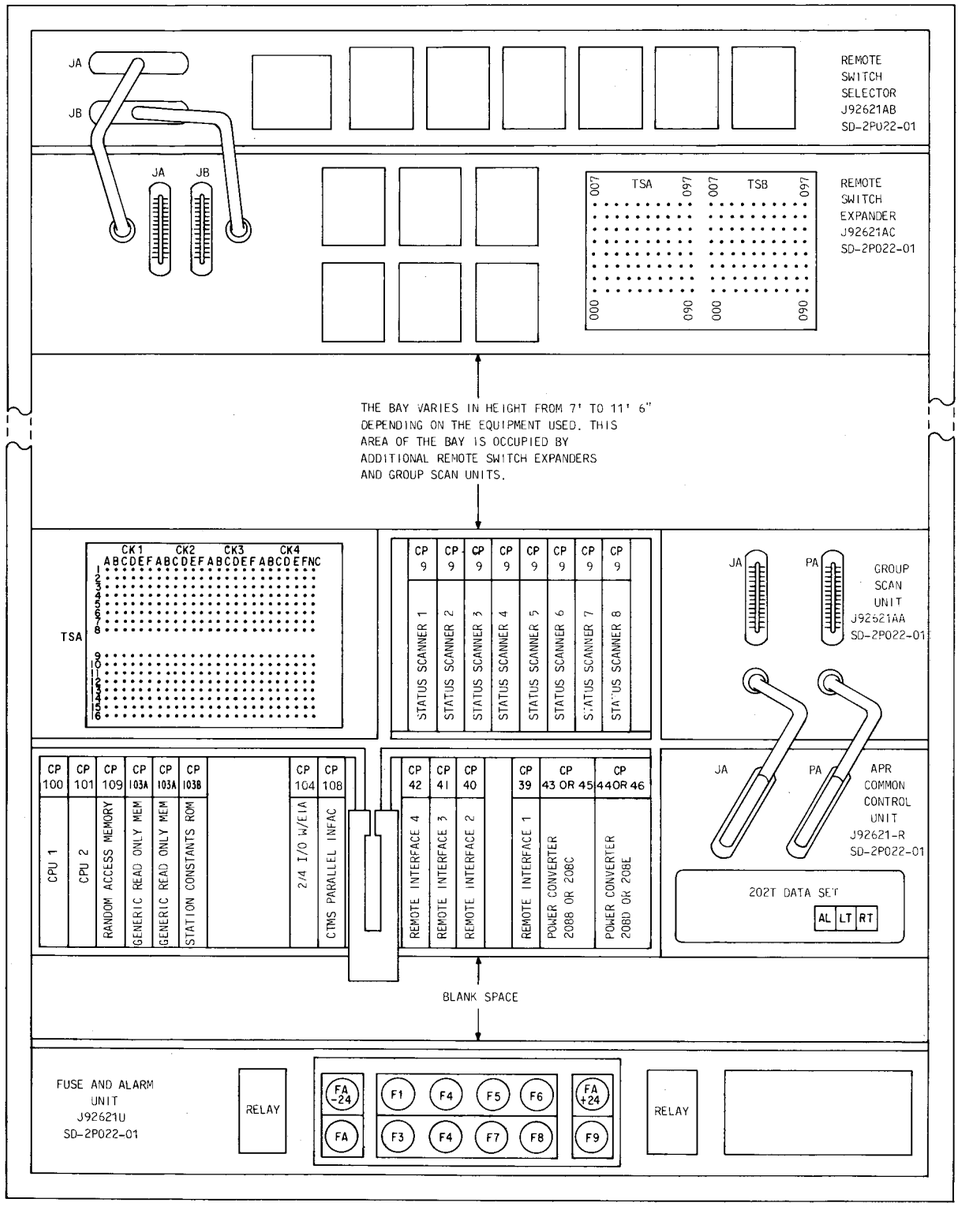
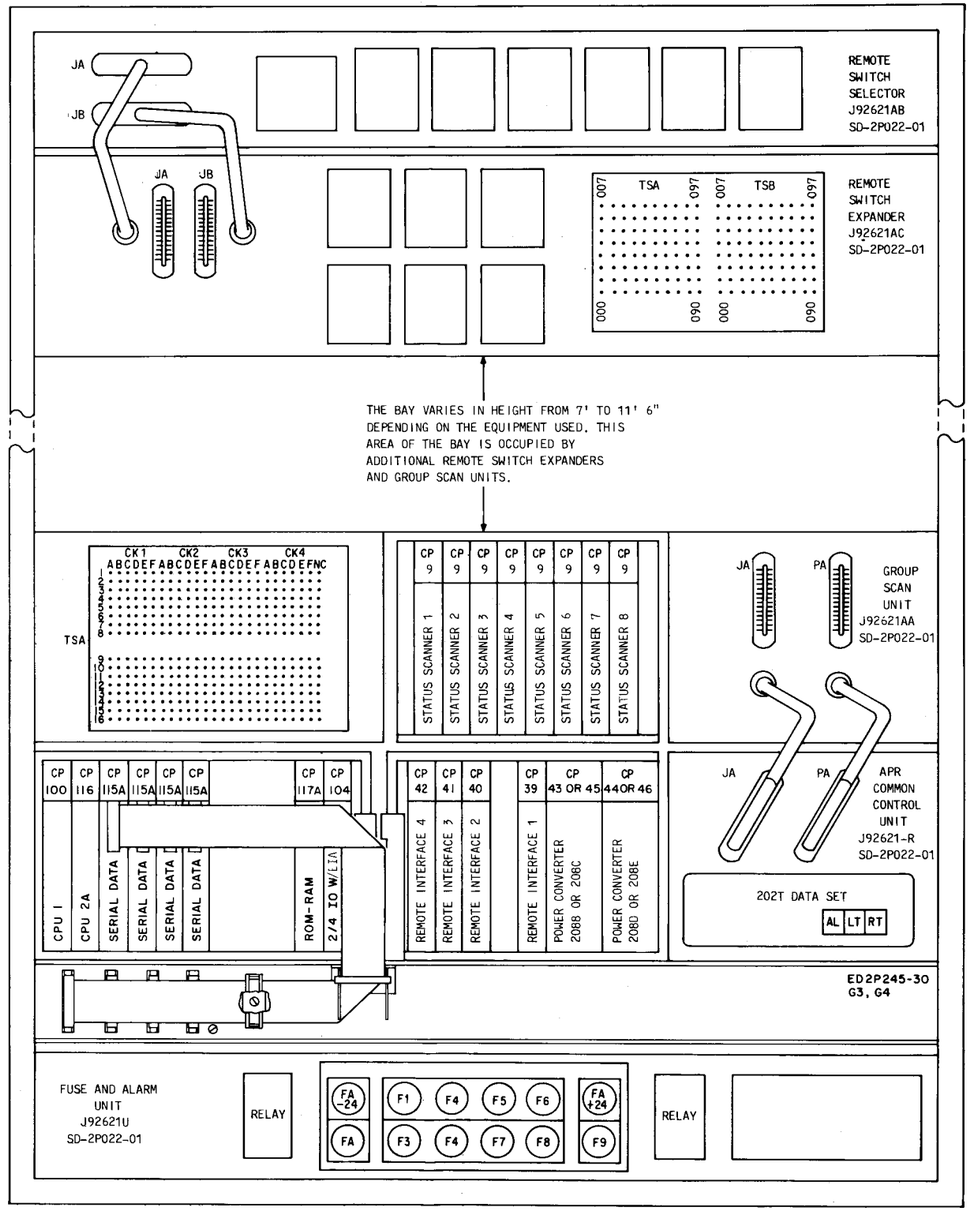


Fig. 1—Typical Alarm Processing Remote Bay

2.04 The J1P029A-L5 E2A alarm processing remote bay is a stand-alone bay arrangement which can accommodate up to 2048 hard-wired status or alarm points. Growth increments are in terms of 64-point displays. The J1P029A-L11 bay provides the same as L5 and up to eight serial ports for an additional 1792 status or alarm points.



(A) J1P029A-L5 (OLD APR)



(B) J1P029A-L11 (NEW APR)

Fig. 2—Alarm Processing Remote Bay Configuration

TABLE A

UNIT	J CODE	NO. OF UNITS PER APR BAY
Remote switch selector	J92621AB	1
Remote switch expander	J92621AC	At least 1
Group scan unit	J92621AA	1 to 8
Bus repeater module 1 unit	J92621T	1*
APR common control	J92621R	1
Fuse and alarm unit	J92621U	1

* Equipped when the fifth group scan unit is added.

TABLE B

UNIT	J CODE	NO OF UNITS PER APR BAY
Remote switch selector	J92621 AB	1
Remote switch expander	J92621 AC	At least 1
Group scan unit	J92621 AA	1 to 8
Bus repeater module 1 unit	J92621 T	1*
APR common control	J92621 R	1
Fuse and alarm unit	J92621 U	1
Interface panel	ED2P245-30	1

*Equipped when the fifth group scan unit is added.

2.05 The J1P029C E2A APR is used only in CTMS. This arrangement can process a maximum of 512 discrete status points and control a maximum of 256 remote switches for CTMS.

2.06 The J1P029D E2A APR is used for direct connection to the No. 1 and No. 1A ESS machines. This unit has EIA ports which in turn terminate on a port on the primary maintenance channel of the No. 1 or No. 1A ESS machines. Each of the three ports has the capability of 1024 points (3072 points total).

2.07 In addition to the 3072 memory-point capability, this arrangement provides telemetry points for the directed line monitor, shelf fuses, maintenance line status indicator, and up to 450 hard-wired carrier group alarm (CGA) points.

2.08 The TCAS and E2A telemetry equipment has been combined into the same bay since the only application of the J1P029D is in TCAS. The bay is coded J98722()E (AE—11 feet 6 inches, BE—9 feet 0 inches, CE—7 feet 0 inches). The

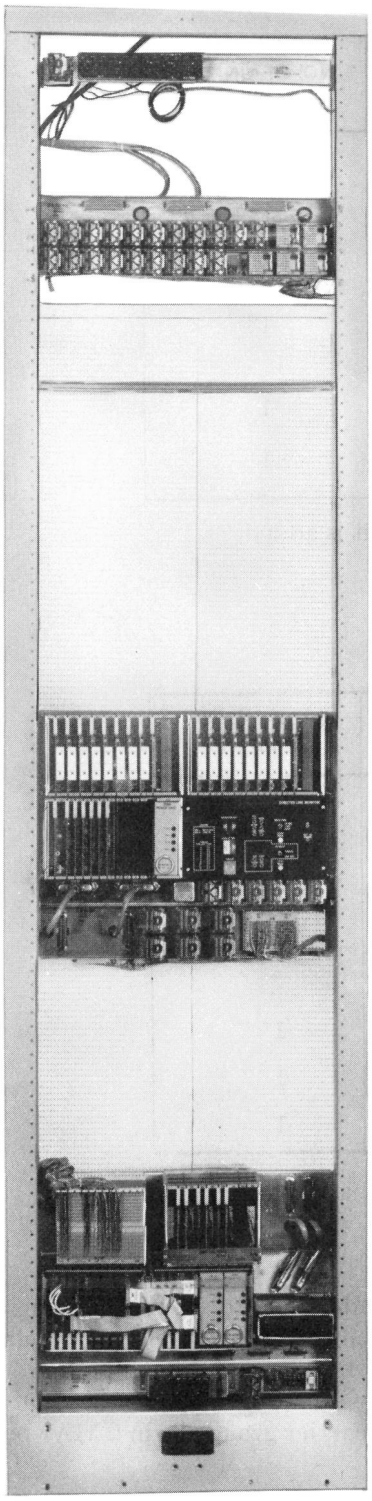


Fig. 3—Typical Alarm Processing Remote With Serial Data Port (J1P029D) Bay

E2A APR with serial data ports bay (Fig. 4) consists of the units listed in Table C.

APR Common Control Unit (J92621R)

2.09 The APRCC unit (Fig. 5) is the main body or brains of the E2A APR. The APRCC performs all status information processing and controls all APR functions. The unit consists of two interconnected circuit pack modules, one containing the PROETEL microprocessor and the other module containing remote interface circuitry. The unit also contains two power converters. One converter supplies +5 and -9 volts to the microprocessor; the other converter supplies +15 and -15 volts to the 202T data set and +5 volts to the scanner. Plus and minus 12 volts is derived from the plus and minus 15-volt supply by interface circuitry for use in the microprocessor. A 202T data set is used to convert the frequency-shift-keyed (FSK) signals from the central terminal to digital coded signals for the E2A APR. The reverse process is also accomplished. It must be noted that the 202T data set is used with the J1P029A and J1P029D bays. It is not used in the J1P029B or J1P029C bay assemblies. Tables D and E list each circuit pack in the APRCC unit with a brief statement of its function.

2.10 Interconnection between the remote interface module and microprocessor module, and between the 202T data set and the input/output (I/O) circuitry (CP 104) is made using ribbon cabling as shown in Fig. 5. The E2A APR with serial data ports (Fig. 6) interconnection is made using the ribbon cabling between panels. When the E2A APR is used with CTMS, a ribbon cable is connected from the rear of the J3 connector (Fig. 7) located on the back of the APRCC unit to the CTMS interface circuit pack (CP 108, LOC MIL). Input to the APR from CTMS interface circuit pack (CP 108, LOC MIL). Input to the APR from CTMS is made through the J3 connector. Since the CTMS equipment and the J1P029B and J1P029C bay assemblies are collocated, no data set is used. The units are directly connected via multipair cables.

Group Scan Unit (J92621AA)

2.11 The group scan unit (GSU) consists of a circuit pack module containing up to eight scanner input circuit packs (CP 9) and circuit terminal block (TSA). The scanner input circuit pack module enables the APR (as directed by the

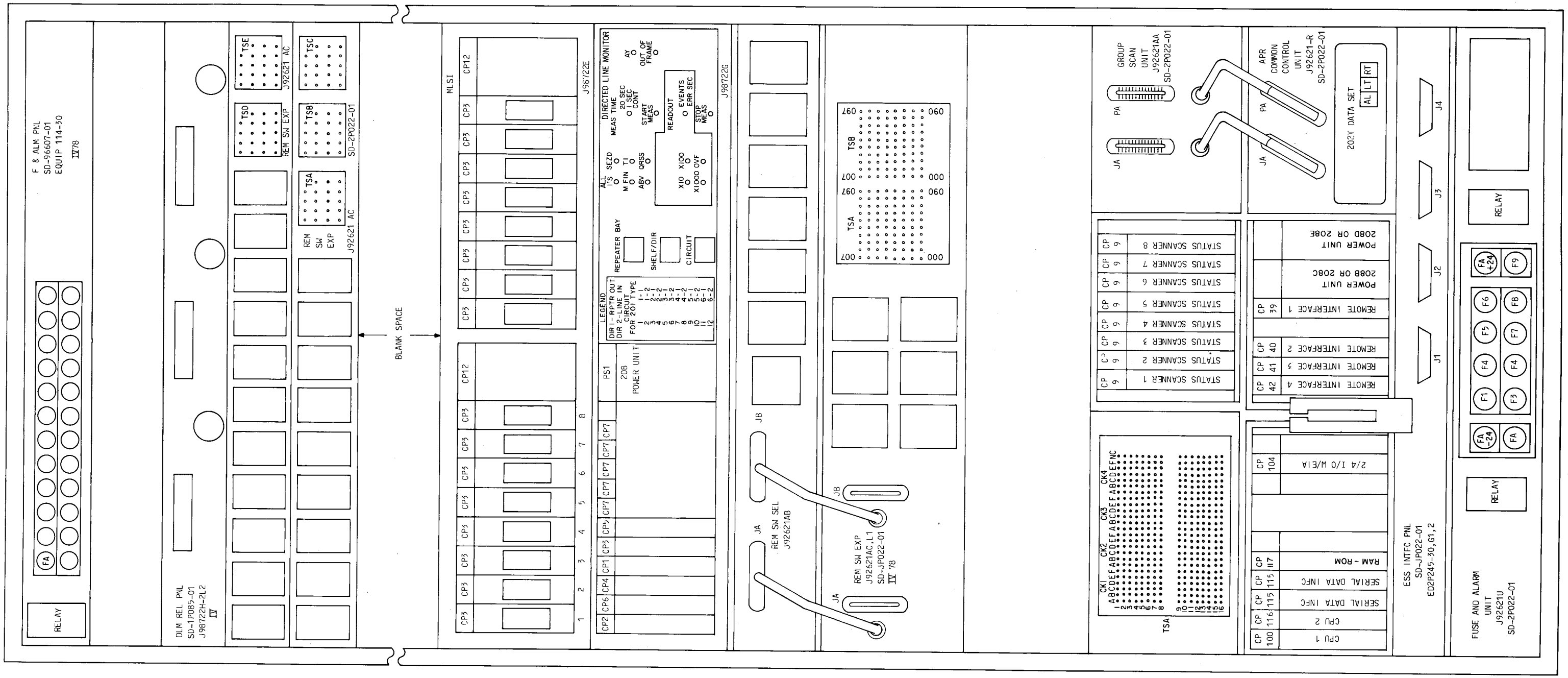


Fig. 4—Alarm Processing Remote Serial Data Port (J1P029D) Bay Configuration

TABLE C

UNIT	J CODE	NO. OF UNITS PER APR BAY
Fuse and alarm panel	ED-1P114-30, G9, A, B, SE	1
Directed line monitor relay panel	J98722H-2, L2	1
Remote switch expander	J9261AC	1 to 3
Maintenance line status indicator	J98722E	1
Directed line monitor	J98722G, H, J	1
Remote switch selector	J92621AB	1
Group scan unit	J92621AA	1 to 3
APR common control	J92621R	1
Interface panel	ED-2P245-30	1
Fuse and alarm unit	J92621U	1

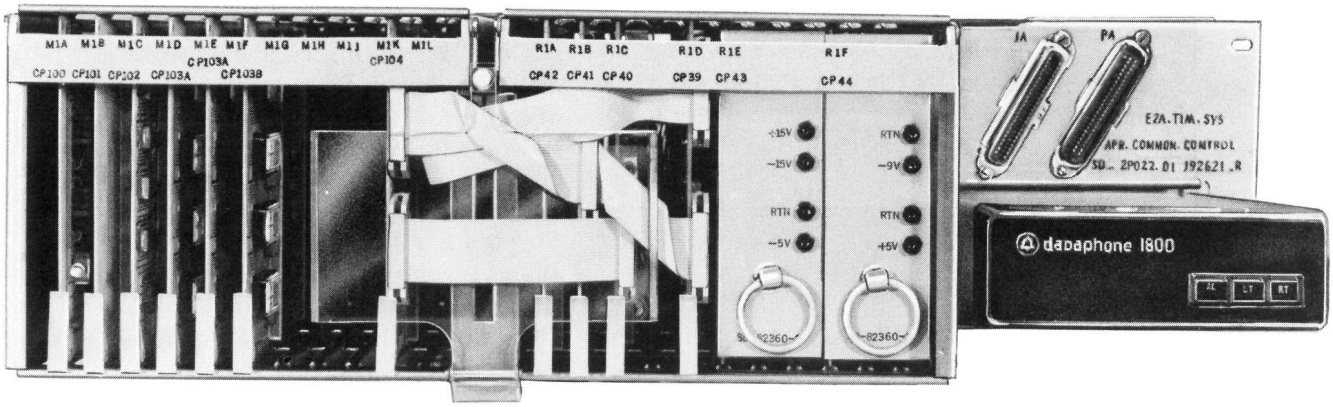


Fig. 5—Typical APR Common Control Panel (Front View)

APRCC) to scan and accept four 64-scan-point displays of status inputs for processing. Input to the scanner circuit packs is made through terminal block TSA on the group scan unit. The scanner circuit packs are tied to the rear of TSA with the four status display inputs (64 bits each) from the office monitored equipment connected to circuits 1, 2, 3, and 4 on the front side of TSA. The TSA is divided into preassigned display addresses, assigned left to right, with two circuit packs corresponding to each display.

2.12 Additional group scan units are installed in the APR bay when needed to increase the number of status inputs which can be accommodated. Each subsequent group scan unit mounts above the preceding group scan unit until a total of four group scan units are mounted in the bay. The first unit is connected directly to the APRCC as shown in Fig. 2. Each additional unit is connected directly to the previously installed unit at connectors JA and PA. Each group scan unit installed is responsible for a specified number of group displays.

TABLE D

MICROPROCESSOR MODULE			
CP	LOC	CP TITLE	FUNCTION
100	M1A	CENTRAL PROCESSING UNIT (CPU1)	This CP contains the 8080 microprocessor and supporting components that perform data processing for the APR.
101	M1B	CENTRAL PROCESSING UNIT (CPU2)	This CP contains memory, plus a clock chip to provide timing signals as well as support functions for CPU1.
102	M1C	2K RANDOM ACCESS MEMORY (RAM)	This is a data storage memory circuit pack. Data is written into and retrieved.
109	M1C	1K RANDOM ACCESS MEMORY	This CP serves basically the same purpose as CP 102, but has only one-half the memory capacity. CP 102 and CP 109 use the same location.
103A (2)	M1D M1E	GENERIC READ ONLY MEMORY (ROM)	Stores the generic programs which perform the common control functions of the APR.
103B	M1F	STATION CONSTANTS PROM	This circuit pack contains memory (ROMS) for station constants firmware consisting of specific unchanging data of individual remote stations. This includes station address, bit rate, display and sub-group numbers, scan point processing, etc.
104	M1K	2/4I/OW/EIA	This is a 2-input by 4-output circuit which allows incoming data via the interface circuit packs to be entered in the micro-processor. This circuit also has direct connection to the 202T data set in accordance with the EIA standard RS232C.
108	M1L	CTMS PARALLEL	This circuit pack provides an interface be-tween the microprocessor and the CTMS data.
115	M1C	SERIAL DATA INTERFACE	This circuit pack is a storage memory circuit and supports up to ASCII ESS ports.
115	M1D	SERIAL DATA INTERFACE	Performs same function as first CP 115.

TABLE D (Contd)

MICROPROCESSOR MODULE			
CP	LOC	CP TITLE	FUNCTION
115A	M1C	SERIAL DATA INTERFACE	This circuit pack is a serial interface circuit and supports two polling serial ports.
115A	M1D	SERIAL DATA INTERFACE	This circuit pack is a serial interface circuit and supports two polling serial ports.
115A	M1E	SERIAL DATA INTERFACE	This circuit pack is a serial interface circuit and supports two polling serial ports.
115A	M1F	SERIAL DATA INTERFACE	This circuit pack is a serial interface circuit and supports two polling serial ports.
116	M1B	CENTRAL PROCESSING UNIT (CPU2A)	This circuit pack contains memory plus a clock chip to provide timing signals as well as support functions for CPU1.
117	M1E	ROM — RAM GENERIC PROGRAM AND STATION CONSTANTS FOR J1P029D AND J1P029A-L5	This circuit pack contains memory (ROMS) for generic programs and station constants firmware consisting of a specific unchanging data of individual remote stations. This includes display and subgroup numbers, scan point processing, etc. It also contains RAM memory for data storage switches for address and bit rate plus LEDs for remote status.
117A	M1J	ROM — RAM GENERIC PROGRAM AND STATION CONSTANT FOR J1P029A. L11	This circuit pack contains memory (ROMS) for generic programs and station constants firmware consisting of specific unchanging data of individual remote station. This includes display and subgroup numbers, scan point processing, etc. It also contains RAM memory for data storage switches for address and bit rate plus LEDs for remote status.

The group scan unit and its associated displays are listed in Table F. Note that displays one through four are INDEX displays.

2.13 There are a total of three group scan units used in the TCAS bay. Table G lists the group scan unit and associated displays.

Bus Repeater Unit (J92621T)

2.14 The first four group scan units are mounted and connected to the APR as stated in paragraph 2.05. However, before the fifth through the eighth units can be used, a bus repeater unit must be installed. This unit provides additional bus drive for the fifth through the eighth group scan units. A total of three scan units are used in the E2A APR to TCAS, therefore, no bus repeater unit is required.

Remote Switch Selector (J92621AB)

2.15 The remote switch selector provides a selector panel for J92621A panels which provide momentary (300 ms) relay closures, when desired, for remote switch control. The unit is a relay tree

TABLE E

REMOTE INTERFACE MODULE			
CP	LOC	CP TITLE	FUNCTION
42	R1A	INTERFACE 4	Interfaces the remote switch expander circuit to the APR microprocessor module.
41	R1B	INTERFACE 3	Interfaces the remote switch selector and expander to the microprocessor module.
40	R1C	INTERFACE 2	Interfaces the scan and control circuits to the microprocessor module. Provides +12 and −12 volts for microprocessor.
39	R1D	INTERFACE 1	Interfaces the scan and control circuits to the microprocessor module.
43 and 44	R1E R1F	APRCC POWER CONVERTERS FOR −24V OFFICES (OPTION Y)	Supplies several voltages to microprocessor module, +5V to connecting scanner circuits.
45 and 46	R1E R1F	APRCC POWER CONVERTER FOR −48V OFFICES (OPTION X)	Performs same function as CPs 43 and 44 at a −48V office.
208C and 208E	R1E R1F	APRCC POWER FOR −24V OFFICES	Supplies several voltages to microprocessor module, +5V to connecting scanner circuits.
208B and 208D	R1E R1F	APRCC POWER FOR −48V OFFICES	Performs same function as 208B at −48V office.

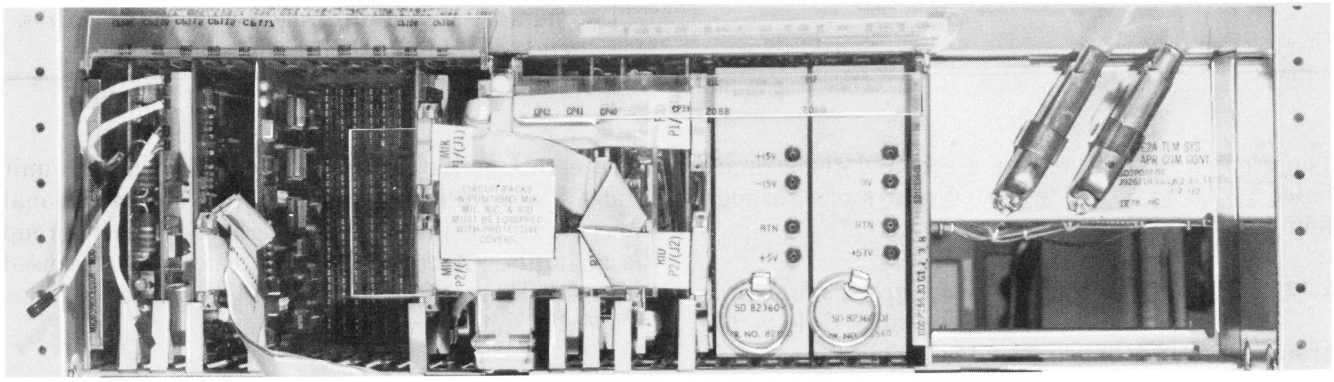


Fig. 6—APR Common Control Unit With Serial Data Port (Front View) J1P029D

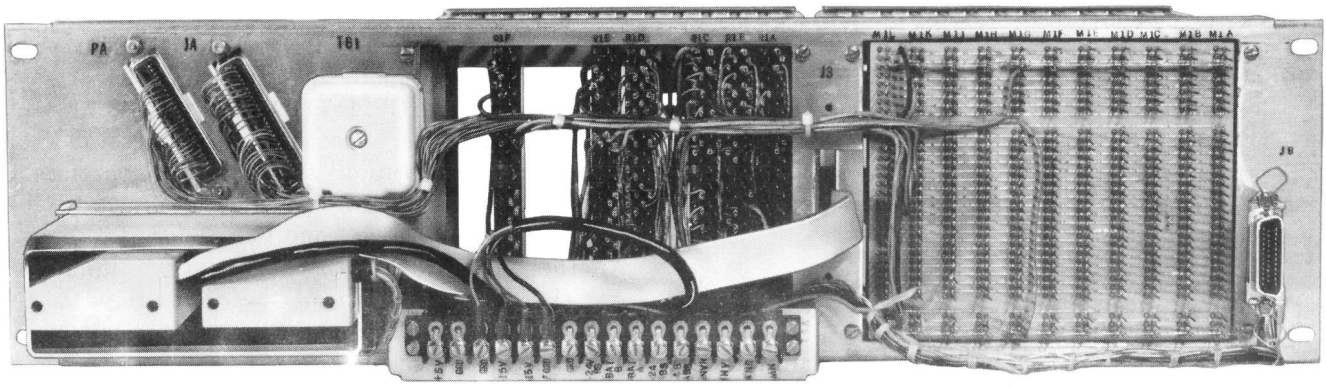


Fig. 7—APR Common Control Unit (Rear View)

TABLE F

GSU	ASSOCIATED DISPLAYS
1	5 — 8
2	9 — 12
3	13 — 16
4	17 — 20
5	21 — 24
6	25 — 28
7	29 — 32
8	33 — 36

TABLE G

GSU	ASSOCIATED DISPLAYS
1	5 — 8
2	9 — 12
3	13 — 16

selector for connecting 1 out of a possible 32 through paths. Control of the remote switch selector is by the APRCC unit via a remote switch command from the central terminal. Connection from the remote switch selector to the APRCC is made via cabling from the rear of the selector to the JB connector on the rear of the APRCC.

Remote Switch Expander (J92621AC)

2.16 The remote switch expander performs as its name implies. It increases, or expands, the number of remote switch operations (momentary relay closures) by 64 per expander unit. At least one remote switch expander is used in an APR bay. However, up to 32 expander units can be equipped in an APR for a maximum of 2048 relay closures.

2.17 The first remote switch expander is mounted in the APR bay directly below the remote switch selector and is connected to the remote switch selector using a cable-connector arrangement (daisy-chain) as shown in Fig. 2. Each additional expander unit is mounted and connected in the same manner, but to the preceding expander. The TSA and TSB terminal strips located on the expander unit link the remote switch control to the office remote switch points. A multiconductor cable from the office is tied, conductor-to-pin, to TSA and TSB.

Maintenance Line Status Indicator (J98722E)

2.18 The maintenance line status indicator provides the ability to bridge a full-time monitor onto each maintenance line or backbone line appearance in the office. The monitor detects bipolar violations and pulse absences and has a violation rate threshold of about 10^{-6}. The unit provides a local display for manual use as well as remoting capability via E-telemetry.

Directed Line Monitor (J98722G)

2.19 The directed line monitor identifies the signal and measures the bipolar violation error rate on a T1 or T1C line. Any central office repeater that is connected to the monitoring system can be measured either by central office forces or by the TCAS central via telemetry.

Repeater Access Unit

2.20 The repeater access unit is a miniature crossbar switch which permits selection of a particular repeater within a bay and passes the bridged line signal to the DLM for analysis. Depending on the equipment configuration, the RAU may access either six or eight shelves of repeaters.

Fuse and Alarm Unit (J292621U)

2.21 The fuse and alarm unit is the power distribution, grounding, and alarm center for the APR bay. This unit receives power from the central office power and distributes it through the APR bay. Refer to SD-2P022-01-B18 for power and fusing arrangement.

3. FIRMWARE

3.01 The APR common control operates under the control of generic firmware for J1P029A-L5, J1P029B, and J1P029C. This firmware is logical step-by-step procedures stored in programmable read-only memory (PROM) integrated circuits mounted on the microprocessor module circuit packs (CP 103A). Another firmware circuit pack (CP 103B) contains station constants (station address, bit rate, etc) and alarm conditioning for all status points (1 to 32 displays equipped as displays 5 through 36). This circuit pack also provides the index displays, both NEW and ANY; and the generic firmware provides ALARM POLL commands, GROUP REPORT commands, REMOTE SWITCH commands, and other controlling procedures.

3.02 For the application of TCAS J1P029D, the firmware and station constants are stored in programmable read-only memory integrated circuits mounted on the microprocessor module circuit pack (CP 117). This circuit pack also contains station address and bit-rate switches. There are also two light-emitting diodes (LED) on the card (one green and one red) which indicate the status of the remote. When only the green LED is on, the remote is operating normally. If only the red LED is on, the remote has failed the memory test indicating a bad CP 117. Any other combination indicates improper operation. The 768 discrete scan points make up all the displays 5 through 16 which are conditioned for bipolar alarms except for display 6 which is conditioned for status only. Another circuit pack (CP 115) supports up to two ASCII ESS ports. Two of these circuit packs are provided to support three data ports required for TCAS/ESS application.

3.03 Special firmware in the E2A monitors the ASCII messages that are sent over the primary maintenance channel and selects those that pertain to CGA or clear conditions. These messages are decoded and translated into a 3072-point memory in the E2A. This information is processed the same as hard-wired status points over the telemetry network to the TCAS central. The 3072-point memory is divided into three 1024-point blocks each of which is associated with an ASCII port. The E2A APR can monitor three ESS ports since each No. 1 or No. 1A ESS may have 1024 CGA points assigned.

3.04 The J1P029A-L11 operates from firmware and station constants stored in PROM that is mounted on the microprocessor module circuit pack (CP 117A). The station constants contain alarm conditioning for all status points (displays 5 through 36 for discrete points and displays 37 through 64 for serial points) and also contains information for the serial ports. This circuit pack also contains station address and bit rate switch information in addition to the two LEDs as described in paragraph 3.02.

4. FUNCTIONAL DESCRIPTION

4.01 Prior to the design of the E2A APR, processing of status information for change of state, alarm definition, etc, was accomplished at the maintenance system central unit or, in the case of E2, at E2 remotes via alarm networks and cross connects. In the E2A APR, this processing is accomplished by the firmware at the remote.

4.02 Referring to Fig. 8, the E2A APR (J1P029A-L5) is constantly monitoring office equipment and scanning all the possible 2048 status inputs. The E2A APR (J1P029A-L11) with polling serial ports, in addition to the 2048 status inputs, scans

up to 1792 inputs approximately every 1 to 2 seconds. The E2A APR (J1P029D) with serial data ports scans all the 768 discrete status inputs. It also monitors the three ESS ports. Each status input is scanned approximately two times per second by the GSU under the control of the central processing unit (CPU). This status input data is retrieved by the GSU (CP 9) and fed to the APRCC. This data is sent to the microprocessor via remote interface and the I/O circuit (CP 104) and stored in the random access memory (RAM) data circuit (CP 109 or with J1P029D, CP 117, or with J1P029A-L11, CP 117A). The stored data is processed by the CPU as directed by the generic programs stored in the read-only memory (ROM) circuits (CP 103, or with J1P029D, CP 117, or with J1P029A-L11, CP 117A). The second scan of status input data is processed and compared with the previous scan. If a change of state is detected (a difference between the present and previous scan), the bit which has changed state is processed according to three masks; that is, to determine if the bit is conditioned for memory and if it is conditioned as an alarm. If it is an alarm, it is processed to determine whether it is unipolar or bipolar mask.

4.03 In the E2A APR with serial data ports (Fig. 9), use its maintenance line status indicator to monitor the lines for violations. The directed line monitor identifies the signals and measures the bipolar violation error rate on these lines. The processed data is then stored in RAM until the remote station is alarm polled and retrieved via display or group reports to the central station or TCAS central via telemetry.

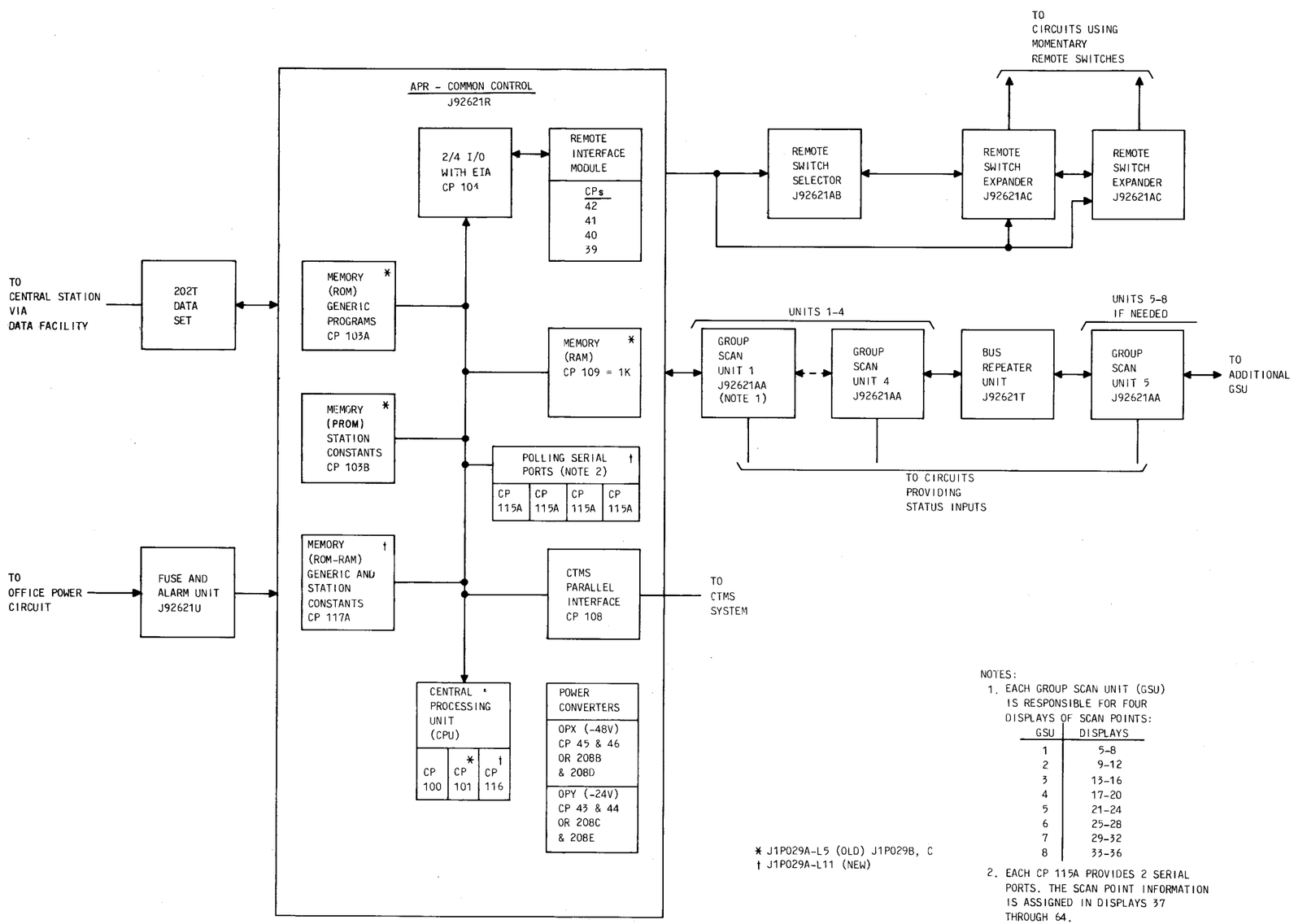
4.04 The central station periodically alarm polls each remote station using the E2 telemetry word format (refer to Section 201-644-112); or in case of SCOTS or TCAS centrals using E2A telemetry format, by sending an alarm poll command to the remote. Note that this is true only if APRs are on the data facility being monitored or a mixture of APRs and E2A units so that operation at 600 or 1200 bits per second can be performed. The APR processes the incoming command in the APRCC and responds with a 17-bit word indicating NO alarms, a NEW alarm, or an ANY (previously acknowledged) alarm. If an alarm is reported, the central will first request an INDEX display report and then a group display report (or a display report in case of E2 manual central), at which time, the data stored in RAM of the APRCC is retrieved by the central. Once the alarm is identified and the problem diagnosed, trouble tickets can be prepared, if necessary. If a remote switch is necessary, the system personnel at the central will send a remote switch command to the APR. The APRCC processes the command and directs the remote switch through the remote switch selector and/or expander.

5. MAINTENANCE

5.01 Maintenance of the E2A APR remote is performed per Section 201-653-522.

6. REFERENCES

DOCUMENT	DESCRIPTION
201-644-112	E2 Status Reporting and Control System—Manual Alarm Central—Description
190-200-010	T-Carrier Administration System (TCAS) Overall System Description
SD-2P022-01	E2A Alarm Processing Remote



* J1P029A-L5 (OLD) J1P029B, C
† J1P029A-L11 (NEW)

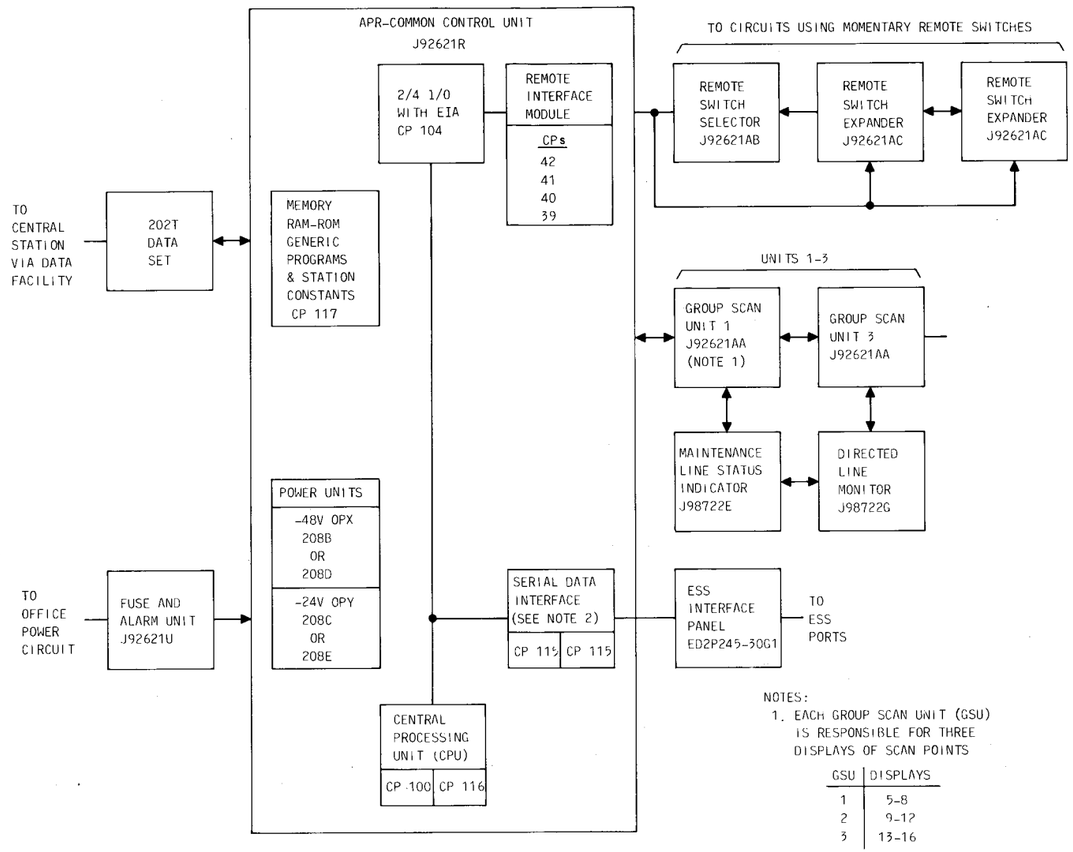
NOTES:

1. EACH GROUP SCAN UNIT (GSU) IS RESPONSIBLE FOR FOUR DISPLAYS OF SCAN POINTS:

GSU	DISPLAYS
1	5-8
2	9-12
3	13-16
4	17-20
5	21-24
6	25-28
7	29-32
8	33-36

2. EACH CP 115A PROVIDES 2 SERIAL PORTS. THE SCAN POINT INFORMATION IS ASSIGNED IN DISPLAYS 37 THROUGH 64.

Fig. 8—E2A Alarm Processing Remote Block Diagram



NOTES:

1. EACH GROUP SCAN UNIT (GSU) IS RESPONSIBLE FOR THREE DISPLAYS OF SCAN POINTS

GSU	DISPLAYS
1	5-8
2	9-12
3	13-16

2. A STARTING DISPLAY NUMBER AND NUMBER OF DISPLAYS ARE ASSIGNED TO EACH PORT

PORT	STARTING DISPLAY	NO. OF DISPLAYS
1	17-32	16
2	33-48	16
3	49-64	16

Fig. 9—E2A APR Serial Data Port Block Diagram