# 5ESS™ SWITCHING EQUIPMENT
# MODULAR METALLIC SERVICE UNIT
# INTERCONNECTION

## SECTION I - GENERAL DESCRIPTION

### 1. PURPOSE OF CIRCUIT

1.01 The Modular Metallic Service Unit (MMSU) provides various peripheral functions required by a 5ESS™ office. These functions include: scanning, signal distribution, automatic line insulation testing, GDX (gated diode crosspoint) compensation, and a metallic access. The MMSU can simultaneously furnish any combination of these functions. The scan and distribute functions are used to monitor and control various points in the 5ESS peripheral hardware. The Automatic Line Insulation Test (ALIT) function determines the quality of subscriber lines and is used in conjunction with the GDX compensator which supplies compensation for leakage in the GDX concentrator during the tests. The metallic access provides a network that connects analog facilities to low frequency test equipment.

## SECTION II - DETAILED DESCRIPTION

### 1. INTERFACES

1.01 The MMSU has five hardware interfaces: the Main Distribution Frame (MDF), peripheral units, other MSUs or Modular Metallic Service Units (MMSUs), the Module Controller Unit (MCU), and the power fuse panel.

1. Scan points and Signal Distribute (SD) points leave the MMSU and go to the MDF where they are cross connected to peripheral hardware that is to be either monitored or controlled.

2. Metallic access is provided by Metallic Test Buses (MTBs) which originate at the MMSU and terminate on peripheral units (Lines Units, Trunk Units, etc.) which also terminate analog facilities.

3. The MMSU is equipped with circuitry which permits interconnection to other MSUs or MMSUs in an office having multiple MMSUs. This interconnection is made via Metallic Test Interconnection Buses (MTIBs) and is required to provide test equipment connected to one MSU or MMSU access to subscriber lines connected to another MSU or MMSU.

4. Two control channels run between the MCU and the MMSU via Peripheral Interface Control Buses (PICBs). Each PICB contains the following: Data In, Data Out, Clock, Select, and Interrupt signals. The control channels connect the duplexed module controlers in the MCU and the simplexed MMSU. Only one of

the duplicated module controllers and one of the duplicated groups of control channels are active at one time.

5. Twelve nominal -48 volt power paths run from the fuse panel to the MMSU. The following table is a list of the fuse sizes that are to be used for each section of the MMSU and also the lug locations for the -48 volt feeders on the MMSU.

**TABLE**

| Section of the Unit | Type | Size | Lug Location |
|---|---|---|---|
| Service Group 0 - Bottom Shelf | | | |
| -48V00 | 70D | 5.0 Amp | 01-016-0B0 |
| -48V01 | 70A | 1.3 Amp | 01-065-0B0 |
| -48V10 | 70D | 5.0 Amp | 01-104-0B0 |
| -48V11 | 70A | 1.3 Amp | 01-153-0B0 |
| Service Group 1 - Top Shelf | | | |
| -48V00 | 70D | 5.0 Amp | 01-016-0B0 |
| -48V01 | 70A | 1.3 Amp | 01-065-0B0 |
| -48V10 | 70D | 5.0 Amp | 01-104-0B0 |
| -48V11 | 70A | 1.3 Amp | 01-153-0B0 |

Note: The fuses are to be inserted under an unloaded condition, which is when all circuit packs are unseated from the unit.

## 2. CONNECTING CIRCUITS

### A. Unit Layout

2.01 The MMSU provides two service groups and consists of a basic unit and up to three growth units. Each service group is partly contained by the basic unit and each of the growth units. The basic unit and the growth units are identical physically but are not equipped the same. Each basic unit service group consists of a power converter (494LA), a Common Pack (TN879), a MTIB Access Pack (TN138), and 8 general circuit packs. The general circuit packs consist of Metallic Access Packs (TN138s), GDX Compensator Packs (TN880s), Scan Packs (TN220Bs), Signal Distribute Packs (TN221s), and ALIT Packs (TN328-TN330). Each growth unit provides an expansion of the two service groups in the basic unit. Each growth unit service group consists of a power converter, a spare pack position where the TN879 would go if the growth unit were the basic unit, a MTIB Access Pack, and 8 general circuit packs. Any general circuit pack can be used in any of the general circuit pack locations. The configuration of the general circuit packs in any given 5ESS office depends on the needs of that particular office. Specifications for these circuit packs are contained in the Office Dependent Data (ODD) and the MDF engineered cross connects. Connections between the Common Pack and the circuit packs in the basic unit are made by backplane wiring and connections between the Common Pack and the growth units are made via pluggable cables and the backplane wiring of that growth unit.

### B. Common Pack Circuitry

2.02 The MMSU Common Pack TN879 provides the MMSU with an interface to the Peripheral Interface Control Buses (PICBs) from the (MCU). All information transferred between the MMSU and MCU is processed by the TN879.

Orders received from the MCU are interpreted by the TN879 and directed to the MMSU circuit that performs the requested function. The TN879 also formats all replies prior to their transmission to the MCU. These replies return the status of any received order and also data when requested by a scan order. The TN879 also provides an interface for sending data and address information from the control logic on the Common Pack to the registers on the various circuits within the MMSU. This interface is accomplished by the Fanout Circuit located on the TN879. The Fanout Circuit has 5 outputs, 1 connected to each of the 4 shelves in a MMSU service group and 1 connected to registers internal to the Common Pack.

C. Metallic Access Pack Circuitry

2.03 The Metallic Access Pack TN138 consists of a 16x4 relay matrix and its associated control logic. The relay matrix is used by the MMSU to interconnect various 5ESS circuits under test with their associated test equipment. Each circuit under test and each piece of equipment has a pair of wires which connect via a distribution frame or directly to 1 of the 16 paired inputs of the TN138. These wire pairs are referred to as Metallic Test Buses (MTBs). There can be as many as 16 junctors per service group in a MMSU (4 per shelf). These junctors are used for metallic connections between circuit packs in the MMSU, and for metallic connections to external equipment via the TN138 Circuit Packs. Each junctor is a pair of wires containing a tip and a ring. The junctors run parallel on the backplane and are connected to the Metallic Test Interconnection Bus (MTIB) Access slot and the 8 general pack locations.

2.04 The TN138 is controlled by orders sent to the MMSU by the MCU. The MMSU Common Pack TN879 receives and interprets these orders and then relays them to the TN138 where they will be used to operate relays, read the status of the relay driver outputs, and perform the requested diagnostic evaluation of the TN138 logic. The Metallic Access Pack may be located in the MTIB Access slot and in any of the 64 general circuit pack locations within the MMSU.

2.05 The MTIB Pack is used in conjunction with backplane cables to interconnect other MMSUs or MSUs in an office having multiple MSUs. This interconnection is made via MTIBs and is required to provide test equipment connected to one MMSU or MSU access to subscriber lines connected to another MMSU or MSU.

D. Alit Pack Circuitry

2.06 The purpose of packs TN328-TN330, Automatic Line Insulation Test (ALIT) circuit is to provide information for preventative loop and cable maintenance in the 5ESS system. The test capabilities of the pack include detection of leakages to battery or ground from tip or ring, and also failures of pressurized cable. The ALIT packs may be located in any of the 64 general circuit pack locations (32 / service group) of the MMSU. The ALIT is controlled by a firmware program that executes in a 8086 microprocessor and all communication to and from the packs is accomplished via the MMSU Common Pack TN879.

E. GDX Compensator Pack Circuitry

2.07 The TN880 GDX Compensator Pack provides the MMSU with the capability of compensating for leakage in the concentrator of the Line Unit. Compensation involves the canceling of leakage current and bias resistance of the concentrator to allow for accurate line testing. Only one TN880 pack is required per test connection. The TN880 is controlled by a firmware program that executes in a BELLMAC™4 microprocessor which provides control

and sequencing for the compensation circuitry along with extensive self-diagnostics. The Compensator pack may be located in any of the 64 general circuit pack locations within the MMSU.

F. Scan Pack Circuitry

2.08 The TN220B Scan Pack provides the MMSU with the miscellaneous scanning capabilities required by the 5ESS system. Each Scan Pack provides 32 scan points, and may be located in any of the 64 general circuit pack locations within the MMSU. Each Scan Pack provides a summary scan of its 32 constituent scan points, where a change in the state of any scan point will cause a service request[1] to be sent to the MMSU Common Pack TN879. The service request is then reported by the Common Pack to MCU via the PICB. In addition, the states of the scan points may be read directly, 16 bits at a time.

G. Distribute Pack Circuitry

2.09 The TN221 Signal Distribute (SD) Pack provides the MMSU with the miscellaneous SD capabilities required by the 5ESS system. Each SD Pack provides 32 SD points, and may be located in any of the 64 general circuit pack locations. The SD points consist of relay closures with 51 ohms series resistance, and the options of providing -48 volts and some external series resistance[2]. When the SD relays are closed, the SD points are defined to be in the "on" state (logical "1"), when the relays are opened, the SD points are "off" (logical "0"). The TN221 is normally a passive circuit pack, receiving all instructions from the MCU via the Common Pack TN879. In normal operation, software must set the state of each SD point, which is then latched on the pack until changed by software. All SD points are bit addressable and can be initialized (reset) two different ways. The first way is with a command from the MCU to the SD Pack via the Common Pack. The second way is with the power up sequence.

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DEPT 55611-JLB-DPS

1. Service requests and interrupts are synonymous.

2. Refer to SD-5D044-01.