1:1 REDUNDANT SWITCHING UNIT
ONE RACK UNIT
(HIGH VALUE SERIES)

_____

1.1 GENERAL DESCRIPTION

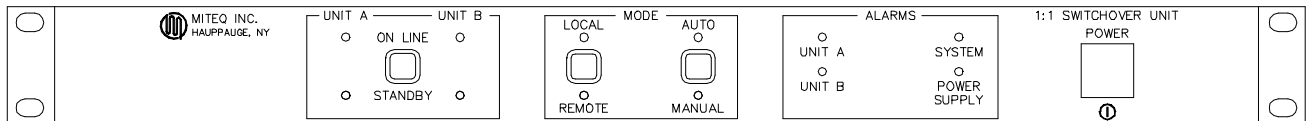### 1.1.1 PHYSICAL

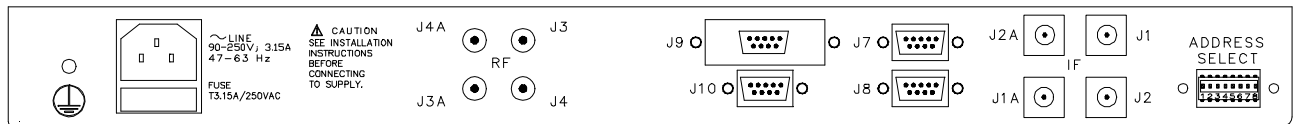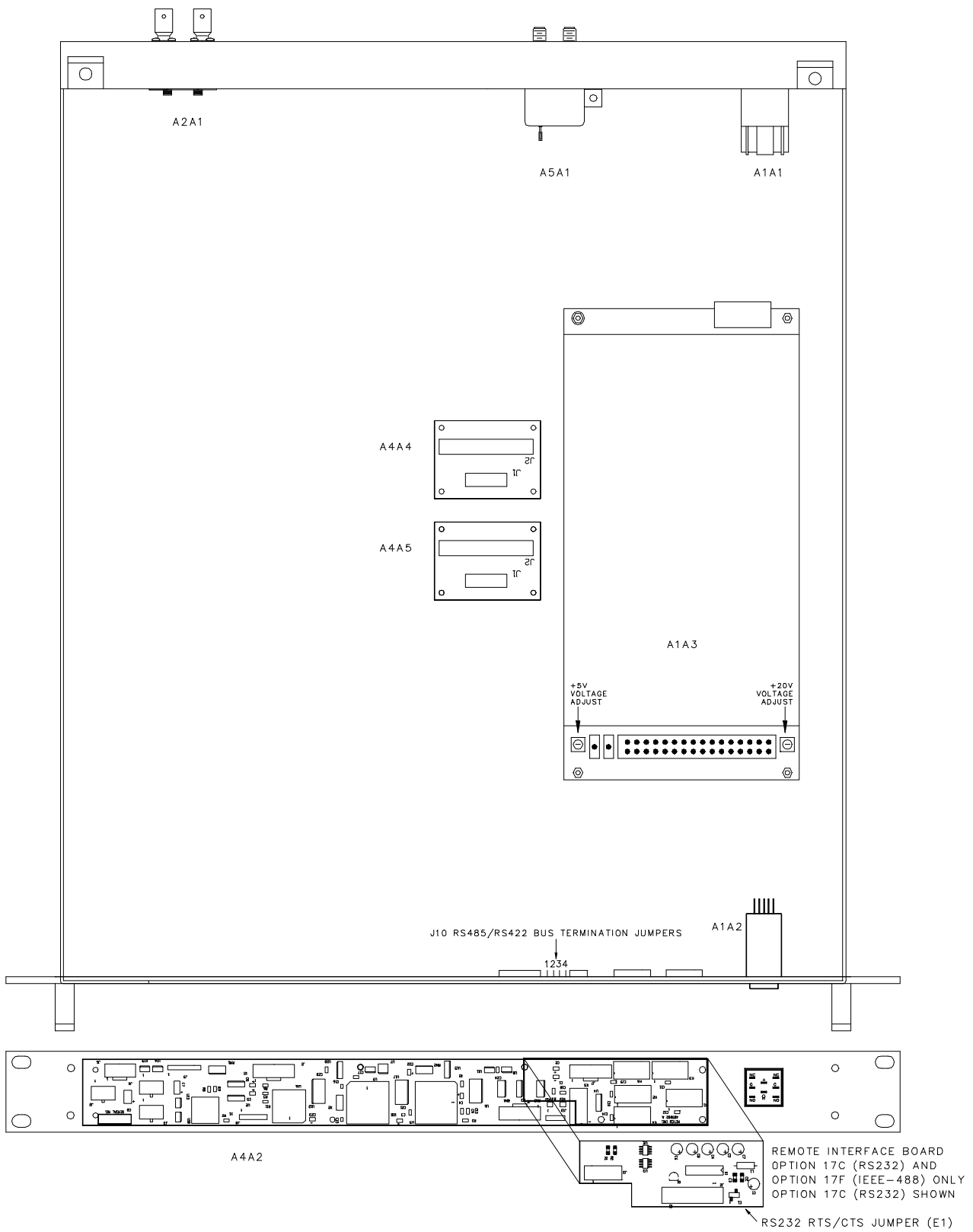**Figure 1-1. Front Panel, 1:1 Redundant Switchover Unit**

Figure 1-2. Rear Panel, 1:1 Redundant Switchover Unit

A2A1

A5A1   A1A1

A4A4
                    J2
                    J1

A4A5
                    J2
                    J1

A1A3

+5V   +20V
VOLTAGE   VOLTAGE
ADJUST   ADJUST

J10 RS485/RS422 BUS TERMINATION JUMPERS   A1A2

1234

A4A2

REMOTE INTERFACE BOARD
OPTION 17C (RS232) AND
OPTION 17F (IEEE—488) ONLY
OPTION 17C (RS232) SHOWN

RS232 RTS/CTS JUMPER (E1)

Figure 1-3. Interior View, 1:1 Redundant Switchover Unit (RSU-B/S-LC Shown)

1.1.2 FUNCTIONAL

The 1:1 Redundant Switchover Unit (RSU) is used with two converters, one On-line (Unit A) and the second in a Standby mode (Unit B). A fault condition in the On-line Unit A, or an operator generated command, will switch the Standby Unit B into the transmission path and remove Unit A from operation.

The RSU is available with remote bus interface options for remote control and monitoring.

Its design ensures continuous operation allowing a fault to be repaired and/or routine maintenance of a converter to be performed without disruption of signal transmission.

1.2 EQUIPMENT CHARACTERISTICS

1.2.1 PHYSICAL

Weight .... 20 pounds nominal
Overall dimensions .... 19" x 20" x 1.75" panel height
IF signal connector .... BNC female
RF signal connector .... SMA female
Unit "A" Alarm Input Connector (J7) DE-9P
Unit "B" Alarm Input Connector (J8) DE-9P
Remote interface connector (J9, J10)
   RS485, RS422 .... DE-9S
   RS232 .... DB-25P
   Contact closure DB-25S
   IEEE-488 .... IEEE-488 receptacle
Primary power input IEC320

1.2.2 FUNCTIONAL

Primary power 90-250VAC
Fuse .... T3.15A (5 x 20mm)
Switch type .... Latching

| 1:1 SWITCHOVER UNIT, SINGLE TRANSFER SWITCH MODELS ||
Model	Frequency Range
RSU-B-LC	50-180 MHz
RSU-S-LC	0.95-18.1 GHz

| 1:1 SWITCHOVER UNIT, DUAL TRANSFER SWITCH MODELS |||
Model	Switch 1 Frequency Range	Switch 2 Frequency Range
RSU-B/B-LC	50-180 MHz	50-180 MHz
RSU-B/S-LC	50-180 MHz	0.95-18.1 GHz
RSU-S/S-LC	0.95-18.1 GHz	0.95-18.1 GHz

RF SPECIFICATIONS				
Frequency	Insertion Loss (Maximum)	Amplitude Flatness/40 MHz (Maximum)	Return Loss (Minimum)	Isolation (Minimum)
50-180 MHz	0.3 dB	0.2 dB	20 dB	60 dB
0.95-4 GHz	0.3 dB	0.2 dB	18 dB	60 dB
4-8 GHz	0.4 dB	0.3 dB	16 dB	60 dB
8-12.4 GHz	0.5 dB	0.3 dB	14 dB	55 dB
12.4-18.4 GHz	0.6 dB	0.5 dB	12 dB	50 dB

Notes: Specifications apply to a single switch.

IF switch (50-180 MHz) is 75 ohm impedance. 50 ohm impedance is available with Option 15.

Signal path configuration -
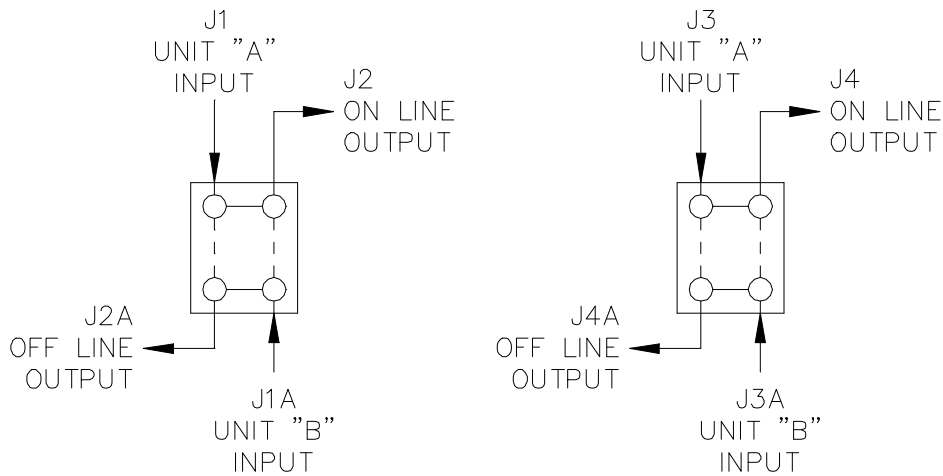
For the **Alarm Input Connectors, J7, J8**, a fault consists of a contact closure applied between Pins 1 and 2.

Remote Interface connector, J9, J10, pin designations are indicated in the table below.

For RS485 two-wire party line operation, DATA IN + must be externally wired to DATA OUT +, and DATA IN - externally wired to DATA OUT -.

Units equipped with RS232 (Option 17C) are shipped with a jumper connecting RTS and CTS. See Figure 1-3 for the location of the jumper.

RS485 AND RS422 (J9, J10)	
PIN	DESIGNATION
1	Ground
3	Data Out -
5	Data In -
7	Data Out +
9	Data In +
RS232 (J9)	
2	RCV Data
3	Tx Data
5	Ground
7	RTS
8	CTS

CONTACT CLOSURE (J9)			
Command (INPUT)	Closed	Common	Open
Unit A On-line/Unit B Standby	3	2	1
Unit B On-line/Unit A Standby	1	2	3
AUTO	6	5	4
MANUAL	4	5	6
Status, Mode, Alarms (OUTPUT)	Closed	Common	Open
Unit A On-line/Unit B Standby	9	8	7
Unit B On-line/Unit A Standby	7	8	9
REMOTE	10	11	12
LOCAL	12	11	10
AUTO	16	15	14
MANUAL	14	15	16
SYSTEM Normal	19	18	17
SYSTEM Fail	17	18	19
Unit A Normal	22	21	20
Unit A Fail	20	21	22
Unit B Normal	25	24	23
Unit B Fail	23	24	25
Signal/Frame Ground: Pin 13			

SECTION 2

INSTALLATION

2.1 UNPACKING, STORAGE, RESHIPMENT

Carefully open the shipping container and remove the equipment. Inspect the equipment thoroughly and report any damage.

If the equipment is to be stored, it should be wrapped in plastic and kept in a clean, dry place.

If the equipment is to be reshipped for any reason, wrap in heavy plastic and ship in a heavy (275 lb. test) double wall carton. At least three inches of a solid packing material should be used on all sides of the equipment. The carton should be marked to indicate that it contains fragile electronic equipment.

2.2 MOUNTING

THIS EQUIPMENT IS NOT FOR USE IN A DOMESTIC ENVIRONMENT.

THIS EQUIPMENT IS INTENDED FOR RACK MOUNTING.

OPERATOR INJURY MAY OCCUR IF UNIT IS NOT PROPERLY MOUNTED.

THIS EQUIPMENT MUST BE SECURELY MOUNTED.

Slides are provided for mounting in a standard 19" equipment rack.

2.3 TURN-ON PROCEDURE

After mounting, make all external connections per Table 2-1.

Apply power to the unit by depressing the front panel power On/Off switch.

System is now operational.

Table 2-1. External Connections

DESIGNATION	DESCRIPTION
Ground Lug	Connect the Ground Lug on the rear panel to the Protective Earth connection of the building.
Power cord	Attach the power cord to the rear panel AC power inlet. Connect the other end to the power source. Refer to national wiring standards for the correct connection to the power source.
Unit "A" Alarm Input Connector (J7)	Connect the Redundancy Alarm output (J7 for most MITEQ converters) of Unit "A" to the rear panel Alarm Input connector. See Paragraph 1.2.2 for wiring information.
Unit "B" Alarm Input Connector (J8)	Connect the Redundancy Alarm output (J7 for most MITEQ converters) of Unit "B" to the rear panel Alarm Input connector. See Paragraph 1.2.2 for wiring information.
Remote Interface Connector (J9, J10)	The Remote Interface connector is an optional connection. This allows the operator to monitor and control the unit from a remote location. See Paragraph 1.2.2 for wiring information.

SECTION 3

OPERATION

3.1 CONTROLS

3.1.1 EXTERNAL CONTROLS

For a description of the front panel keypad and select switches see Paragraph 3.2.1.

AC Power

Use the power on/off switch to control AC power to the unit.

Fuse

The AC power cord must be removed to access the fuse which is located in the AC inlet assembly.

Device Address and Baud Rate Selection (Service Request for IEEE-488)
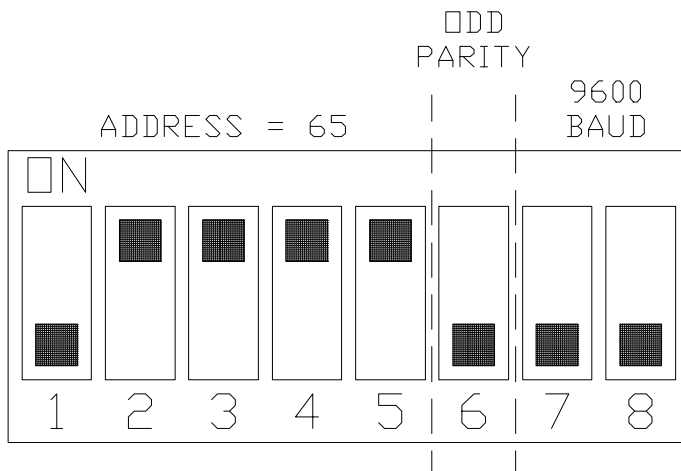
The device address is set with the ADDRESS SELECT switch on the rear panel.

S1, 2, 3, 4 and 5 select the five LSBs of the address in binary (switch Off = "1", switch On = "0", S1 = LSB). The two MSBs are permanently set to "10" and not available to the user.

The baud rate and parity are selected with switches S6, 7 and 8 in the following code (switch Off = "1", switch On ="0").

S8	S7	Baud Rate
0	0	1200
0	1	2400
1	0	4800
1	1	9600

S6	Parity
0	Even
1	Odd

```
                           ODD
                         PARITY
                                       9600
                         |      |      BAUD
         ADDRESS = 65    |      |
        ON
       ┌──┬──┬──┬──┬──┬──┬──┬──┐
       │  │▓▓│▓▓│▓▓│▓▓│  │  │  │
       │  │  │  │  │  │  │  │  │
       │▓▓│  │  │  │  │▓▓│▓▓│▓▓│
       └──┴──┴──┴──┴──┴──┴──┴──┘
         1  2  3  4  5  6  7  8
                         |      |
```

For IEEE-488 operation, S1, 2, 3, 4 and 5 select the address assignment in binary (switch Off = "1", On = "0", S1 = LSB). Switch 8 enables the Service Request feature (switch Off = Disabled, On = Enabled). S6, 7 are spares.

```
              ADDRESS = 3        N/A     SRQ
                                        ENABLED
       □N
       ┌──┬──┬──┬──┬──┬──┬──┬──┐
       │  │  │ ▉│ ▉│ ▉│  │  │ ▉│
       │  │  │  │  │  │  │  │  │
       │ ▉│ ▉│  │  │  │  │  │  │
       └──┴──┴──┴──┴──┴──┴──┴──┘
        1  2  3  4  5  6  7  8
```
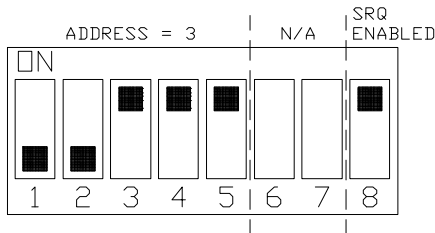
3.1.2 INTERNAL CONTROLS

Power Supply Output Voltage Adjustment

Power supply output voltage is adjusted from the potentiometer located on the power supply. See Figure 1-3 for the location of this adjustment. Any adjustment should be made using an insulated tuning tool. Voltage tolerances are 20.5 ± 0.25V is +5.35 ± 0.2V.

RS485 Bus Termination

A jumper selectable 120 ohm termination resistor is connected across the DATA + and DATA - terminals. The resistor is installed by connecting a jumper across E1 (J10 Pins 1 and 2) which is located on the printed circuit board directly behind the front panel. Remove the cover and use Figure 1-3 to locate the components.

RS422 Bus Termination (Option 17A Only)

A jumper selectable 120 ohm termination resistor is connected across the DATA OUT + and DATA OUT - terminals and across the DATA IN + and DATA IN - terminals. The DATA OUT resistor is installed by connecting a jumper across E1 (J10 Pins 1 and 2)and the DATA IN resistor is installed by connecting a jumper across E2 (J10 Pins 3 and 4). The jumpers are located on the printed circuit board directly behind the front panel. Remove the cover and use Figure 1-3 to locate the components.

RS232 RTS/CTS Jumper (Option 17C Only)

The RTS/CTS jumper is located on an auxiliary printed circuit board assembly which is plugged into the main front panel circuit board (refer to Figure 1-3 for the location of this board). A jumper plug is installed which connects the RTS output and CTS input signals together. The jumper must be removed if it is necessary to use the RTS/CTS protocol. Remove the cover and use Figure 1-3 to locate the RS232 Interface Board and the components.

3.2 OPERATING MODES

The operating modes are selected from the front panel or over the remote bus.

AUTO Mode

In this mode the On-line/Standby status of Unit "A" and Unit "B" is controlled automatically without operator intervention. The On-line/Standby status (position of the transfer switches) is changed when an alarm is detected at the Alarm Input Connectors. On-line/Standby status control is locked out from both the front panel and the remote bus.

MANUAL Mode

On-line/Standby status is controlled by an operator either from the front panel or remotely. Unit "A" and Unit "B" faults are still monitored but have no effect on the On-line/Standby status.

LOCAL Mode

On-line/Standby status and Auto/Manual mode may be selected from the front panel. Remote control is locked out. However, the equipment will still respond to monitoring commands.

REMOTE Mode

On-line/Standby status and Auto/Manual mode are selected from the remote bus. The front panel is locked out with the exception of the Local/Remote switch.

3.3 FRONT PANEL

The front panel display and indicators have been organized so that important information is available at a glance. The keypad is divided into functional groups which allow an operator to easily change any parameter from the front panel. See Figure 1-1 for the physical layout of the front panel.

Keypad Operation

A beep will acknowledge each valid keypress. The error tone will sound when an illegal key is pressed.

Local/Remote Select Key

For RS485, RS422 and RS232 –

The Local/Remote key is alternate action and switches the unit between Local and Remote modes. When in Remote mode the other front panel keys are locked out, and the unit is controlled over the remote bus. Local mode unlocks the front panel. While in Local mode the unit will still respond to commands over the remote bus but will not allow data to be changed.

For IEEE-488 –

The unit is placed in Remote mode by any command received over the IEEE-488 interface. When the unit is Remote mode, the other front panel keys are locked out, and the unit is controlled over the remote bus. The unit can be taken out of Remote mode by the Local/Remote key.

Auto/Manual Select Key

The Auto/Manual key is alternate action and switches the unit between Auto and Manual modes.

When in Auto mode, the On line/Standby status of Unit "A" and Unit "B" is automatically controlled by the RSU. Switchover occurs only if an alarm is detected at the Alarm Input Connectors. The On line/Standby Select key is inoperable.

When in Manual mode, the On line/Standby status of Unit "A" and Unit "B" is manually controlled by the operator. The RSU will monitor alarms detected at the Alarm Input Connectors, but these alarms will not effect On line/Standby status. The On line/Standby Select key is used for local control.

On Line/Standby Select Key

The On line/Standby Select key is alternate action and switches the status of Unit "A" and Unit "B" between On line and Standby status.

Alarm LEDs

The Unit "A" and Unit "B" Alarm LEDs indicate a detected fault at the Alarm Input Connectors.

The System Alarm LED indicates a detected fault in the RSU power supply or in the RSU control board circuitry.

The Power Supply LED indicates a detected fault in the RSU power supply.

3.4 REMOTE OPERATION AND PROTOCOL

The equipment is supplied with an RS485, RS422, RS232 or IEEE-488 bus interface. The command structures for the serial buses are identical. The IEEE-488 format is similar with the exception that no header, address, trailer or checksum bytes are included in the structures.

3.4.1 SERIAL REMOTE PROTOCOL (RS485/RS422/RS232)

The command structures for the serial buses; RS485, RS422 and RS232 are identical. All transmissions are multi-byte sequences beginning with a header byte and ending with a trailer byte and checksum byte. The transmitted bytes are all ASCII printable characters in the range of 20H to 7EH.

Serial data format is a 10 bit sequence consisting of 1 Start, 7 Data, 1 Parity, and 1 Stop bit. All characters, including the checksum character, are checked for parity. If any character in a command message contains an error (parity, framing or overrun) or the checksum is incorrect, the command is ignored and no response is made. The response time from command to acknowledge is 100 ms. maximum.

All messages addressed to the equipment are acknowledged with a response message. The unit continually monitors the communication bus and will accept commands, addressed to it, even in Local mode. When in Local mode, receipt of any commands which change parameters will be ignored and the unit will respond with an error code.

The response time from command to acknowledge is 100 ms. maximum. Since all bytes are ASCII printable characters, a compatible terminal may be used to control the equipment or monitor traffic on the communication bus.

3.4.1.1 SERIAL MESSAGE FORMAT

The serial message format is as follows:

> HEADER - ADDRESS - COMMAND/ERROR CODE - PARAMETERS - TRAILER - CHECKSUM

The Header byte is 7BH, ASCII character "{".

The address may take on the values from 64 to 95 decimal (40H to 5FH).

Parameters are all ASCII printable characters in the range of 20H to 7EH. Numeric parameters are sent MSD first, LSD last. Values which do not adhere to the command format, or are beyond the allowable range, will be rejected and cause the unit to respond with an error code.

The Trailer byte is 7DH, ASCII character "}".

The checksum byte is the sum modulo 95 of all message characters beginning with the header byte up to and including the trailer byte. The value 32 is subtracted from each character value before taking the modulo 95 sum. The value 32 is added to the final sum to obtain the checksum value. All values are in decimal.

> Checksum = MOD [(character value - 32), 95] + 32

Below is a program, written in the 'C' programming language that illustrates the checksum calculation.

```
/*
   return the checksum character for the message in array
   subtract 32 from each character before taking modulo 95 sum
   add 32 to the final sum
   mes_len = message length
*/
char check_sum(char *array, char mes_len)
{
char i,sum;

  for (i = 0, sum = 0; i < mes_len; i++) {
   sum += *array++ - 32;
   sum %= 95;
  }
  return(sum + 32);
}
```

3.4.2 IEEE-488 MESSAGE PROTOCOL

The equipment performs the basic Talker and Listener functions as specified in the IEEE-488 Standard. It is also capable of sending a Service Request to the active IEEE-488 Controller and will respond with a status word when the Serial Poll Enable message is received.

The messages to and from the unit are ASCII character strings terminated with CR, LF and EOI. The response time from command to acknowledge is 100 ms. maximum.

3.4.2.1 IEEE-488 MESSAGE FORMAT

The IEEE-488 message format is as follows:

COMMAND CODE - PARAMETERS

DATA FORMAT commands determine the unit's response when it is addressed to talk by the IEEE-488 Controller. The context of the unit's response remains in effect until another DATA FORMAT command is received. The response to the DQ command is in effect at power up as the default format.

Parameters are all ASCII printable characters in the range of 20H to 7EH. Numeric parameters are sent MSD first, LSD last. Values that do not adhere to the command format, or are beyond the allowable range, will be ignored.

3.4.2.2 IEEE-488 SERVICE REQUEST

When the SRQ is enabled, The unit will issue a service request (activate the SRQ line) when a system fault is detected. The fault may be caused by Unit "A", Unit "B", the power supply, or a circuit board failure. The IEEE-488 Controller responds by sending the SPE message (Serial Poll) and addresses the unit to talk. The unit responds with the following message:

<u>Bit Number</u>

7	6	5	4	3	2	1	0
0	1	0	0	0	S2	S1	S0

The S"n" bits indicate in binary code which component fault line caused the service request (a = 0, b = 1, c = 2, etc.).

The IEEE-488 Controller may perform a Serial Poll without a service request being generated by the unit (the request may have been generated from another device on the bus). In this case, the response will be the same message (the data field will be the same as the last status word sent), however, bit 6 will be at "0".

3.4.3 COMMAND CODES

3.4.3.1 COMMAND CODE SUMMARY

Commands

ASCII Character String	Function
P	Set On line/Standby Status
U	Set Auto/Manual Mode

Status Commands (RS485, RS422, RS232 Only)

ASCII Character String	Function
Q	Return Fault Status
R	Return Mode
S	Return On line/Standby Status

Data Format Commands (IEEE-488 Only))

ASCII Character String	Function
DQ	RSU/Unit "A"/Unit "B" Fault Status Format
DR	RSU Mode Format
DS	Unit "A"/Unit "B" On line/Standby Status Format

Error Codes (RS485, RS422, RS232 Only)

ASCII Character	Function
a	Command not recognized
b	Illegal parameter or parameter out of range
c	Unit in Local mode
d	Busy

3.4.3.2 SET ON-LINE/STANDBY STATUS = P

The unit responds to the set command in REMOTE mode only.

Command: Pa

RS485, RS422, RS232 Response: P

P = Command Indicator

a = 0 Unit "B" On line, Unit "A: Standby
a = 1 Unit "B" Standby, Unit "A" On line

3.4.3.3 SET AUTO/MANUAL MODE = U

Command: Ua

RS485, RS422, RS232 Response: U

U = Command Indicator

a = 0 Manual
a = 1 Auto

3.4.3.4 RETURN FAULT STATUS = Q (RS485, RS422, RS232 Only)

Command: Q

RS485, RS422, RS232 Response: Qabc

Q = Command Indicator

a = Unit "A"
b = Unit "B"
c = System

    0 = Normal
    1 = Fault

3.4.3.5 RETURN MODE = R (RS485, RS422, RS232 Only)

Command: R

RS485, RS422, RS232 Response: Rab

R = Command Indicator

a = 0 Remote
a = 1 Local
b = 0 Manual
b = 1 Auto

3.4.3.6 RETURN ON-LINE/STANDBY STATUS = S (RS485, RS422, RS232 Only)

Command: S

RS485, RS422, RS232 Response: Sa

S = Command Indicator

a = 0 Unit "B" On line, Unit "A" Standby
a = 1 Unit "B" Standby, Unit "A" On line

3.4.3.7 FAULT STATUS FORMAT = DQ (Power On Default, IEEE-488 Only)

Command: DQ

IEEE-488 Response: Qabc

Q = Command Indicator

a = Unit "A"
b = Unit "B"
c = System

   0 = Normal
   1 = Fault

3.4.3.8 RSU MODE FORMAT = DR (IEEE-488 Only)

Command: DR

IEEE-488 Response: Rab

R = Command Indicator

a = 0 Remote
a = 1 Local
b = 0 Manual
b = 1 Auto

3.4.3.9 ON LINE/STANDBY STATUS FORMAT = DS (IEEE-488 Only)

Command: DS

IEEE-488 Response: Sa

S = Command Indicator

a = 0 Unit "B" On line, Unit "A" Standby
a = 1 Unit "B" Standby, Unit "A" On line

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