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A SYSTEM DRAWINGS
B    POWER SUPPLIES
 Guarantee and service facilities

This instrument is guaranteed for a period of five years from its delivery to the purchaser covering the replacement of defective parts other than tubes.

We maintain comprehensive after sales facilities and the instrument can, if necessary, be returned to our factory for servicing. The Type and Serial Number of the instrument should always be quoted, together with full details of any fault and the service required.

The Service Department can also provide maintenance and repair information by telephone or letter.

Equipment returned to us for servicing must be adequately packed preferably in the special box supplied, and shipped with the transportation charges prepaid. We can accept no responsibility for instruments arriving damaged. Should the cause of failure during the guarantee period be due to misuse or abuse of the instrument, or if the guarantee has expired, the repair will be assumed authorized and charged unless other instructions are received.

OUR SALES, SERVICE AND ENGINEERING DEPARTMENTS ARE READY TO ASSIST YOU AT ALL TIMES.

Gould Advance GmbH,
Maximilianstr. 3/5
D-64105 Seligenstadt, Germany
Tel: 06121/62-01-07
Telef: 4181656

Quartix Inc.
P.O. Box 349
5000 North Auburn Drive
Cleveland, Ohio 44131
Telephone: (216) 462-7705
TWX: 910-587-4034

Gould Advance Limited
P.O. Box 349
5000 North Auburn Drive
Cleveland, Ohio 44131
Telephone: (216) 462-7705
TWX: 910-587-4034
The Gould Advance MDT family of power supplies is a range of very compact units employing direct-off-line switching techniques in order to reduce physical dimensions to a minimum. The range consists of two units, both producing the same three independent output voltages of 5V, 12V, or 15V. The output voltages are adjustable by ±5% or ±10% by means of screwscrews adjustments on the front panel. Facilities are provided for local or remote sensing and for a limited amount of voltage programming by means of an externally connected resistor. Constant current protection is provided against overloads or short circuits on all outputs together with auto-resetting thermostat protection against prolonged short circuits on the 12 or 15V outputs. Overvoltage protection by means of a control circuit is switched off provided on all units. Particular attention has been paid during the design stage to the problems of interference caused by the switching action of the power supply circuits. In respect sample units have met the requirements of VDE0876, Curve IV, and 38000 kHz TV power.

The MDT-208 is fitted with a soft-start facility to reduce input current surges at switch-on.

### Specification

**Input**
- **MDT-20A**
  - Voltage: 120V, 230V, 250V
  - Current: 1 A, 5 A
- **MDT-208**
  - Voltage: 120V, 230V, 250V
  - Current: 1 A, 5 A

**Outputs**
- Main output 1: 5V, 20A, Voltage adjustable ±5% by front panel potentiometer. Auxiliary output 1: 12V, 5V (set by internal limits), 1.75A, Voltage adjustable ±10% by front panel potentiometer. Factory set at 12V.
- Auxiliary output 2: Identical to Auxiliary Output 1.

**Overload Protection**
- Constant current on all outputs, set to 110% ± 5% of full load.
- AUTO-RESET thermostat shuts down all outputs if a prolonged short circuit occurs on an auxiliary output which gives rise to excessive heat sink temperature.

**Overvoltage Protection**
- All outputs shut down if voltage of main output exceeds 120%–130%. No protection of auxiliary outputs.
- Temperature Range: -10°C to +70°C, operating on all outputs at 50°C ±1°C.
- Series and Parallel Operation: Main outputs cannot be connected in parallel. Auxiliary outputs can be connected in parallel without limit. The main output can be eneuated in series with the outputs of units with a similar current rating (such as other MDT-20A or MDT-208 until up to a maximum of 36V). Auxiliary outputs can be connected in series with each other or similar units up to a maximum of 36V.
- Ripple
  - Main output: 10mV rms, 50mV peak-peak (500kHz Bandwidth).
  - Auxiliary outputs: 3mV rms, 20mV peak-peak (10kHz Bandwidth).
- Temperature Coefficient: All outputs less than ±0.01%/°C.
- Output Impedance
  - Main output: 100Ω ≤ 100kHz.
  - Auxiliary outputs: 250Ω ≤ 100kHz.

**Output Hold-up**
- Output maintained for the duration of a mains mains cycle at 10% input voltage when the unit is supplied by 5V 25V to 20 Amps and 2 x 15V to 1.75 Amps.

**Control Board**
- The switching regulator control board may be removed from the front panel and is available as an interchangeable replacement part.

**Efficiency**
- In excess of 60%, typically 65%, at full load on all outputs.

**Insulation**
- Between AC input and all output terminals and case connected together, tested to 2kV peak for one minute.
- Between any two DC outputs and between each DC output and case: ≤ 250V DC, continuous, tested to 500V DC for one minute. Insulation resistance not less than 1000MΩ at 500V DC input to earth and output to earth.

**Power Density**
- Approx. 3Wr/min square inch (62W/1000cc).

**Switch-on Time**
- MDT-20A Outputs will reach specification within 5 cycles of 50Hz or 60Hz input.
- MDT-208 Soft-start circuit will allow outputs to reach specification within 30ms.

**Transient Response**
- Main output: For step load changes of 10-100% or ±10-100% voltage deviations are typically 400mV and output voltage returns to within the regulation band in approximately 2.5mS.
- Auxiliary outputs: For step load changes of 10-100% or ±10-100%, output will recover to within 10mV of the regulation band within 10mS.

**Remote Sensing**
- Available on front panel for all outputs. Voltage drop should not exceed 0.5V total.
- See output characteristic curves for limitation on the main output.

**Remote Programming**
- On main output units only: with limit of ±2.5V peak.

**Mechanical Standard**
- BS4318 preferred metric dimensions and isometrics are required.

**Operation**

**Input Connections**
- AC supply input to the unit is connected to the terminal block on the left of the front panel. The terminals are marked in blue, red, brown, brown, and black. A transparent cover is provided.

**Output Characteristics**
- An inherent advantage in the design concept of switching power supplies is that it is possible to trade off three fundamental aspects of the specification against each other.
  - Input voltage failure hold up time.
  - Negative input voltage margin.
  - Output voltage (including lead voltage drop).

**Output Connections**
- The leads to the unit are available for remote sensing and are available for local sensing and auxiliary output terminals. These conditions the unit may operate down to 85% with 5V backup (current cycle missing) or down to 75% with 10V backup (half-cycle missing). There may be a trade off between master and auxiliary output power. For specific cases consult the manufacturer.

**External Voltage Programming**
- This facility is available on the main output only. The output voltage may be programmed remotely by removing the link marked on the six-way terminal block and connecting the programming resistor between the low terminal and +5V. Programming ratio 1000Ω/5V.

**Mounting**
- Four M3 fixing holes are provided in the unit and in any of the little panels necessary to mount the unit from the front or from above the unit may be operated from an inverted position with limitation of all of the specification.
**Operation**

**Input Connections**
The AC supply input to the unit is connected to the terminal block on the left of the front panel. The terminals are marked L1, L2, and L3. A transparent cover is provided.

**Output Characteristics**
An inherent advantage in the design concept of matching power supplies is that it is possible to trade off three fundamental aspects of the specification against each other.
The three aspects are:
1. Input voltage failure hold up time.
2. Negative input voltage margin.
3. Output voltage (including load voltage drop).

The MGT 208 series has been designed for a 28 V hold-up time at an output voltage of 106% at -10% input. Externally, referring to the block diagram of Fig. 3 for an MGT 208, it can be seen that a circuit operates as follows:
- The input voltage is controlled by a transformer CSR 201 feeding the reservoir capacitor C103. For 115 V units the rectifier is connected as a voltage doubler feeding directly into a pair of high-speed filter capacitors.
- The resulting unregulated DC voltage of approximately 350V is used as the power supply for a regulated DC-DC converter, operating at a frequency of 35 kHz.

**Circuit description**

**General**
The following is a generalised description of the circuit with reference to the block diagram of Fig. 3.

**Main (Master) Output**
This is the main output that is monitored by the main input circuit to sense any changes in the output voltage.

**Overvoltage Circuit**
This circuit is used to monitor the output voltage and is implemented using a voltage divider. If the output voltage exceeds a certain threshold, it will trigger an alarm or shut down the equipment.

**Auxillary Outputs**
These outputs are used to monitor various parameters of the system and provide feedback to the control circuit.

**Mounting**
Four M3 fixing holes are provided at the base of the unit and one of the side panels. It is necessary to mount the unit from the bottom to the side panel at the point of attachment without limitation of any area or from above the unit may be operated in the inverted position without limitation of any area of the specification.

**Cooling**
The power supply is convection cooled and under normal operating conditions does not require forced air cooling. The unit should be mounted to allow the free passage of air through the unit in the vertical direction. This is of particular importance in the area of the heat sink. Units may be mounted adjacent without limitation.
Unit test procedure

1. Fit supply fuse.
2. Proof Voltage Test. After the unit has passed the assembly test, it has to be subjected to this full test as laid out below. A voltage of 1100 volts d.c. is to be applied between input and earth under the conditions detailed below. This voltage is to be increased over a period of 20 secs to 2100 volts d.c. and maintained for 1 minute, after which the voltage is to be reduced to zero and the test probes removed.
3. Test Conditions. The voltage to be applied between the inputs ... contacts to be screwed together and connected to earth.
4. Note: 1. It is necessary to isolate the main switch which can be destroyed.
5. 2. Ensure that capacitor is discharged.
6. 3. This particular test to be observed by the C.A. is repeated tests of this nature will stress the insulation and cause damage. If a further check of insulation is required by the C.A. at the date of despatch then this test to be carried out as a normal insulation test.
7. 3. Insulation Test Input. The inputs to be short circuited together and the insulation measured at 500 volts d.c. between input and earth.
8. Output. The outputs to be short circuited together and the printed circuit edge connectors to be shorted together and connected to the output terminals. The insulation measured at 500 volts d.c. between outputs and earth. This test to be carried out after the diodes have been reconnected. Insulation resistance to be greater than 500MΩ for input and output.
9. Voltage Setting & Function Test. Set all loads to approximately 50% and turn the 12V supply to its minimum. Adjust the AOT resistors R12 and R22 so that the 16V No. 1 and 2 output voltages are approximately 16V. Fit the nearest 5% preferred value resistor. Short out R21 and R22 and check that the output voltages drop to approx. 12V. Turn all potentiometers anti-clockwise and check that the output voltages correspond to the limits in the table then turn the pots fully clockwise and re-check against the specified limits. Remove the shorts on R21 and R22 and re-check the limits on the 16V outputs.
10. Nominal Put fully anti-clockwise Put fully clockwise
11. 5 4 6 5
12 11 2 12 5
13 14 5 12 5
14 15

5. Voltage Programming Test. With the load resistors set for 50% load, switch off, re-program the lossy and externally programme the main output with a 5Ω resistor. The 12V output will remain within 1% of nominal.
6. Note: The resistor used should be 25pΩ 0.1% type.
7. 6. Current Limit. Adjust the AOT resistors R12, R22 and R23 so that the 6V, 15V op 1 and 15V op 2 respectively current limit between 10% and 15%. Current limit is defined as when the output voltage has dropped by 1 volt for all op amps. Short-circuit the 12V outputs, switch on and check that the thermostat TH 1 operates. (This may take to 10 minutes to happen.)
8. Efficiency Test. Test load current to nominal, output voltage to nominal and measure efficiency. This should exceed 6% and typically be 85%.
9. Output Watts Efficiency: Output Watts
10. Ripple and Noise. With load set to full current, the ripple should be within 50mV p-p and the 12V output filters within 50mV p-p to 1kHz on the 12V output and within 300mV p-p and 200mV p-p to 1kHz on the 15V outputs.
11. 5. Overvoltage Test. By using the remote programming facility, program the 12V output voltage until the trip overload level is 6V to 6V. Check that all outputs are turned off by the trip.
12. Soft start Test. (Not applicable to MTS-20A unit.) Equipment required: Storage oscilloscope
13. 16 volt power supply
14. 1000Ω 1 W W W resistance connected in series with the input neutral wire.
15. (a) Before connecting input power to the unit, connect the 16V supply to the auxiliary input for a period of about 2 seconds to ensure discharge of main reservoir capacitor.
16. (b) Set scope to storage mode, one-shot sweep (timebase 50 to 500ms/div). Monitor the waveform appearing across the 100Ω resistor in the neutral line. Switch the unit on at rated load and observe the stored display. The maximum peak amplitude of the stored waveform shall be 2 Volts.
17. (c) Check that all output voltages are within 1% of their set value within 300mV.

Setting up procedure for P.C.B Assy 63397

Equipment Required.
1. Oscilloscope DC 10MHz Bandwidth
2. DC Power Supply

Settable to 10V
3. 17 V
100mA at 150mA

1. Constant Current Sources —
(a) 1mA = 2Ω
(b) 12mA = 100Ω
2. 2Ω Decade Resistors Bases to cover range 10Ω — 15Ω
3. 2Ω Resistors 2kHz 1%. 1Ω, connected from Pins 3 and 4 respectively to Pins 5 and 6.
4. Edge Connector, Double-Advanced Pt. 5213.
5. Suitable connection wires and probes.

Procedure
1. Apply 16V between Pin 1 (+) and Pin 0 (−)
2. Set oscilloscope for 2V/cm and 10us/cm and connect between Pin 14 of IC2 and — power line, the waveform of Fig. 1 should be observed.
3. Increase the sensitivity of the oscilloscope to 2V/cm, and display the peaks of the waveform. Adjust the R46 decade box to minimize the voltage difference between alternate peaks, i.e., reduce R19. This adjustment should be done with the scope timebase desynchronized.
4. Connect oscilloscope between Pin 3 and — power line. The waveform of Fig. 2 should be observed.
5. Connect oscilloscope between Pin 4 and — power line, and check that the same waveform is observed. Apply 1mA constant current between Pins 12 and 13 and select R37 to cause the trailing edge of the pulse to start closing in towards the leading edge. Remove the 1mA source.
6. Apply 12-4mA constant current between Pins 18 and 20. The observed waveform should change to that shown in Fig. 3.
C COMPACT 80 WIRING DIAGRAMS
D  COMPACT 120 WIRING DIAGRAMS
E  COMPACT 200, 201 & G.T. WIRING DIAGRAMS
F  COMPACT 48 WIRING DIAGRAM
H COMPACT TAPE
N  (MMS) CIRCUIT DIAGRAMS

See MMS Handbook for MMS circuits