xerox

arseam

E117-1017 NMP-1000 Manual Rev 1 1991_REDACTED.pdf

01/06/20 09:16 AM

Xerox® WorkCentre® 7855

TRIGA® Reactors

E117–1017
REVISION 1

OPERATION AND MAINTENANCE MANUAL
NMP-1000 LINEAR POWER CHANNEL

GENERAL ATOMICS

LIST OF EFFECTICE PAGES

Page Number	Page Count	Revision
i through vi	6	0
1-1	1	0
2-1 through 2-9	9	0
3	0	0
4-1 through 4-13	13	0
5	1	0

Total Pages	30	

DANGER - HIGH VOLTAGE

When this equipment is energized, voltages approaching 1000 V are present. Use extreme caution when performing calibration, installation, or maintenance.

CONTENTS

FIGURES

GENERAL DESCRIPTION

The NMP-1000 pulse monitoring channel (Fig. 1) is a linear manual and automatic range switching current-to-voltage signal conditioning device which includes adjustable bistable trip circuits for local and remote alarms, and isolated current outputs for display by other devices. The instrument is packaged in a flameproof steel enclosure with metallic conduit connectors.

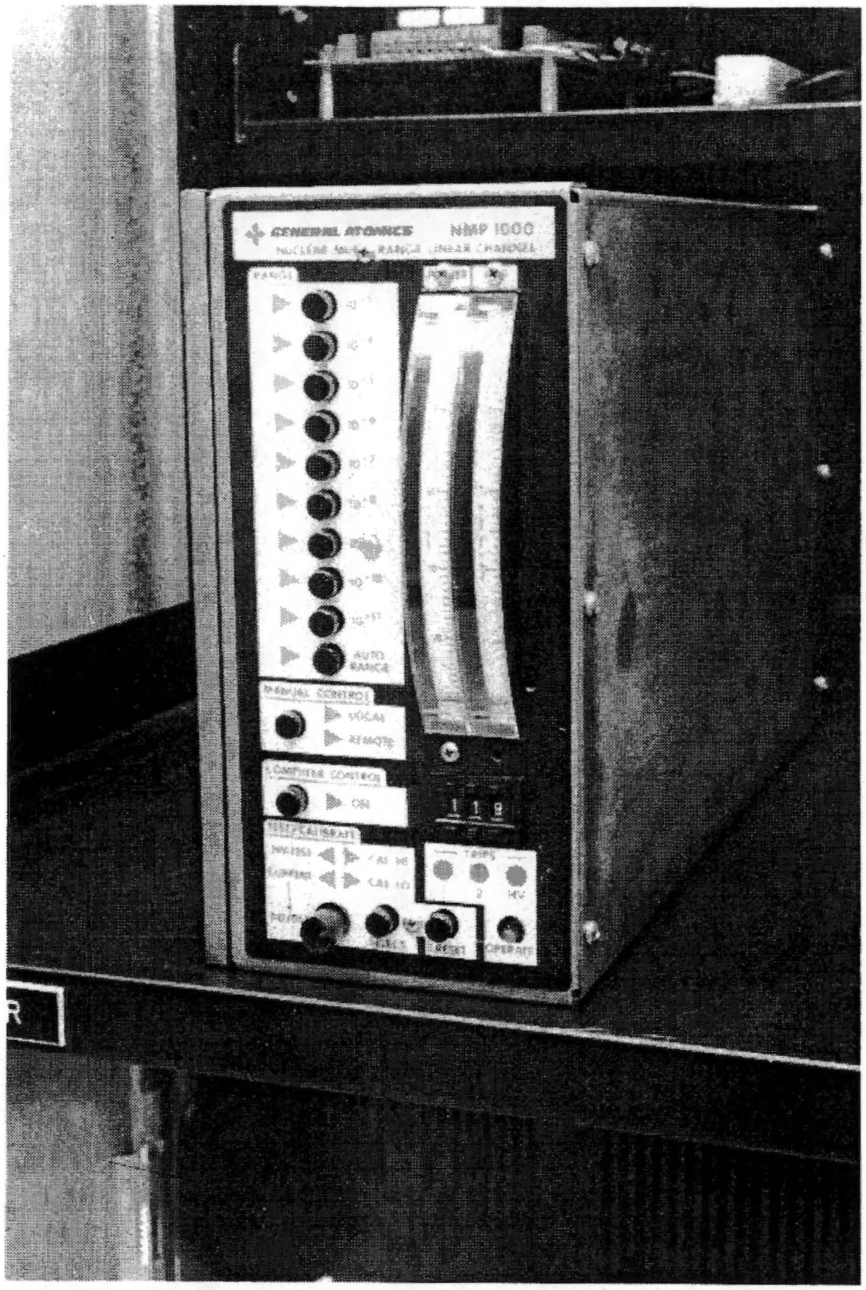

Fig. 1. NMP-1000 Pulse Monitoring Channel

1. SPECIFICATIONS

Input Range	10^{-11} to 10^{-4} A or 10^{-10} A to 10^{-3} A in seven one decade ranges. Self-bailing illuminated pushbutton or automatic range switching (manual or auto, operator selected). Provision for remote range switching.
Linearity	±1.0% of full scale upper 5 ranges; ±2.5% of full scale lower 2 ranges.
Temperature coefficient	±0.15%/°C maximum in the range of 10° to 55°C.
Calibration/test	Two fixed currents for calibration, one adjustable current for multi-range function test and trip testing. HV trip test, test modes selected sequentially by front panel control.
Response time constant	1 msec 10^{-6} to 10^{-3} A; 10 msec 10^{-9} to 10^{-6} A; 100 msec to 10^{-11} to 10^{-9} A.
Outputs	Remote meter: 0-10 V full scale Remote meter: 0-1 mA full scale Recorder: 0-0.1 V full scale Recorder: 0-1.0 V full scale Optional: 4-20 mA full scale High voltage: 300 to 800 V dc at 2.6 W Compensation: 0 to -150 V dc
Bistable trips	High voltage trip High power trip High power alarm Adjustable with +5 V logic level and two form C contacts per trip
Power required	117 V ac ±10%, 50/60 Hz at 1.0 A

2. THEORY OF OPERATION

Refer to the schematic diagram at the back of this document and Figure 2-1.

2.1. INPUT SECTION

2.1.1. Range Switching Relays

The detector current applied to J1 is connected to the electrometer circuit via K611, a low-leakage reed relay, used to disconnect the detector during test and calibration. The electrometer consists of AR601 and associated gain control resistors and relays. AR601 is used as an inverting amplifier with a maximum gain of 1 x 10^{-12} amps/volt set by the feedback network consisting of R603, R605 and R604 (10^{-11} GAIN). K601 is a low-leakage reed relay used to disconnect all feedback resistors for the higher current ranges. At 10^{-10} amps full scale and above, K601 is closed. K602 and K603 are closed at 10^{-9} amps full scale and above. The net gain is reduced by 90% as each successive divider circuit is switched in. Each relay is driven by one section of a Darlington array (U408 and U409). K610 is driven by Q603 in test mode.

2.1.2. Range Selection (Manual)

The range switching relays may be selected manually or through the auto ranging logic circuitry. Manual selection is performed by closing the appropriate section of S201 (S201-A through S201-K) which is an interlocked, 10 position self-bailing switch array. As a range selection is made, the switch provides a ground (logic low) signal to one input of U404, a decimal to BCD (Binary Coded Decimal) encoder. The BCD encoder provides low logic outputs to U405 (strobed hex inverter) which are inverted to operate U406, a presetable BCD counter enabled by using logic high inputs. U405 is a 3-state device such that the counter may be preset by an external system. The BCD output from the counter is decoded by U407 which provides logic level outputs to the relay drivers and range indicator LED's.

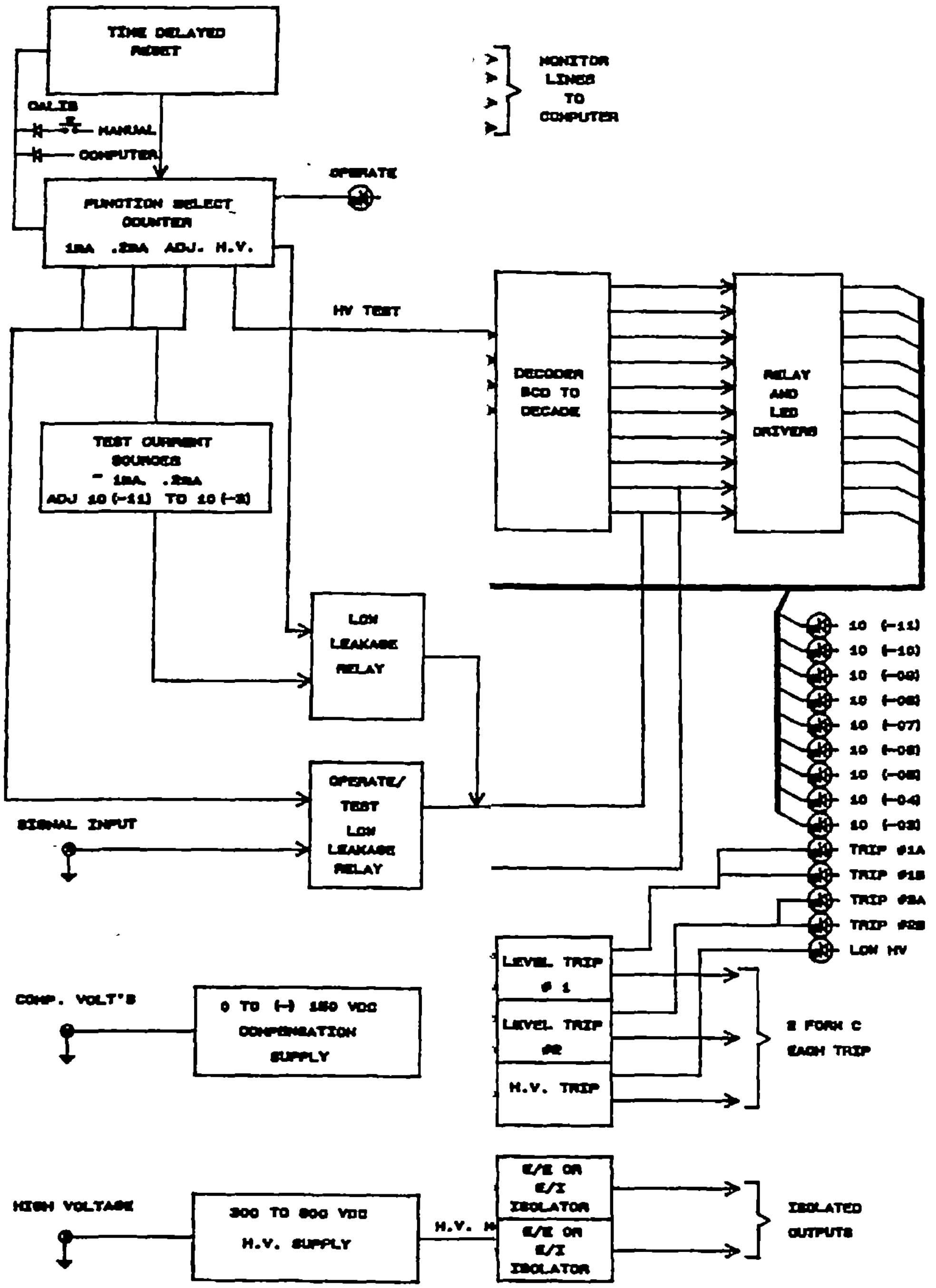

Fig. 2-1. NMP-1000 function flow diagram

As an example, S201-F (10^{-8} range) is pressed providing a ground (logic low) to U404-12 which is the input selection for decimal "2". The output of the encoder U404 is binary equivalent of the decimal number "2" (0010) at U404 pins 9, 7, 6 and 14 respectively. The logic levels are inverted by U405 and preset into U406. The output of U406 is decoded by U407 from the binary 0010 to provide a logic high on U407-2 which drives U408G to illuminate DS206 (10^{-8} LED) and K604. The output of U407-2 is also applied to U410-5 providing the logic to drive U409-E, F and G to power K601, K602 and K603 respectively. These relays provide the required resistive feedback to the electrometer circuits to provide 10^{-8} amps full scale.

2.1.3. Range Selection (Auto)

R416

The output of the electrometer amplifier (AR601) is buffered by AR401 (meter amplifier) on the digital board. The output of this amplifier also drives two comparators AR402A (down level) and AR402D (up level). R424 is adjusted to provide a DC voltage at AR402-13 as the setpoint for the up level switch point. When the input voltage at AR402-12 is more positive than at AR402-13, the UP comparator is driven to a logic high at pin 14. R41 is adjusted to provide a DC voltage at AR402-3 as the setpoint for the down level switch point. When the input voltage is more negative than at AR402-2, the DOWN comparator is driven to a logic high at pin 1. The switch points are nominally adjusted for 108% (9.00 VDC) of the POWER meter full scale for the UP level comparator and 8% (.667 VDC) for the DOWN level. Diodes D411 and D413 disconnect the comparator outputs from the UP/DOWN select logic when the meter amplifier voltage is between 8% and 108%.

D414

Assume that the detector current is 5 x 10^{-8} amps and that the system has been stable for some time. The detector current increases to 3 x 10^{-7} amps. As the meter amplifier (AR401) voltage increases it is felt on the inputs of both AR402A and AR402D. When the voltage at AR402-12 is at 9.00 V and becomes more positive than pin 13, the output of AR402-14 swings positive which provides a logic high to one input of U411B. Diodes D412 and C414 provide an or gate for the inputs from the UP and DOWN comparator outputs. The other input is from the clock (U411C and U411D). When both inputs of U411B are high, the output of U411B is low. The clock pulse from U411C and U411D will toggle the output at about 1HZ. This clock pulse is applied to U406-15 which advances one decimal increment for each positive transition of the clock if U406-10 is held high by the

UP/DOWN select logic of U411A (U406 will decrement one count for each positive transition of the clock if U406-10 is held low by the UP/DOWN select logic of U411A). As U406 advances, the decoded count will shift the high signal from U407-2 to U40715 which will energize K605 and illuminate DS205 (10^{-7}) and de-energize K604, changing the sensitivity from 1 x 10^{-8} to 1 x 10^{-7} full scale. The meter amplifier voltage will then be about 1.0 V so both comparator outputs will be low, the clock gate will be inhibited and U406 will neither increment nor decrement.

When the detector current decreases, the meter amplifier (AR401) output voltage decreases at the inputs of AR402A and AR402D. As the voltage at AR402A decreases to the DOWN level switch point applied to AR402-3, the output of comparator AR402A swings positive. This logic high is applied to one input of U411A which causes the output to go low. The output of the UP/DOWN select logic gate (U411A) goes to U406-10 which will allow the counter to decrement the decimal count when the clock pulses are input to U406-15. As U406 decrements, the decoded count will shift the high signal from U407-15 to U407-2 which will energize K604 and illuminate DS206 (10^{-8}) and de-energize K605, changing the sensitivity from 1 x 10^{-7} to 1 x 10^{-8} full scale. The meter amplifier voltage will then be about 8.0 V so both comparator outputs will be low, the clock gate will be again inhibited and U406 will neither increment nor decrement.

2.1.4. Computer Control

Provision is made for remote and computer control. When Remote control is selected by S202, K501, K502 and K503 are energized to switch the range control function to an external bailing switch connected to J6. "Dry" switch contacts and auxiliary LED outputs are available.

Counter U406-1 is a preset enable input which allows the operator to "jam" control parameters from local and remote control sources regardless of the input current. When U406-1 is low, the "jam" inputs are ignored and the clock controls the counter. The three state inverting buffers (U402 and U405) are used to determine local or external control over the preset parameters. When S204 is switched to computer control position, the output circuits of U405 are disabled due to high impedance and U402 is enabled to accept BCD control from buffer U40-1. BCD logic is provided to U402 from the input buffer U401 and when computer control is selected by S204, the BCD output of U402 provides the input to U406 for range selection. U401 is used as a buffer to convert the 5 volt logic

from the Flux Controller to the 15 volt level required by the NMP-1000. Output BCD signals are buffered by U403 for use by the Flux Controller. The optional Flux Controller communicates via RS232C to external devices as required by the customer.

2.2. TRIP CIRCUITS

2.2.1. Bistable Trips

Three bistable trips are used to alarm on low high-voltage and two independently adjustable levels of output power. Three relays (K404, K405, and K406) are provided with two sets of normally open and normally closed contacts for customer use. The relays are held energized in a fail-safe condition until an alarm de-energizes the coil.

2.2.2. HV Trip

AR403 monitors the 100:1 voltage divided output of PS101 (3 to 8 volts) representing 300 to 800 volts DC detector bias voltage. R462 (HV TRIP SET) is set for a minimum desired operating voltage. If 700 VDC is the minimum detector operating voltage, R462 would be adjusted to provide 7 VDC at AR403-9. With the PS101 operating at above 700 VDC, AR403-9 will remain more negative than AR403-10 which will keep the output at pin 8 positive (+13 to +14.5), thereby holding Q408 in conduction which keeps K406 energized. If the high voltage drops below the nominal setting of 700 VDC, the potential at AR403-10 will be more negative than AR403-9 and the output of AR403-8 will swing negative turning off Q408. With Q408 not conducting, the +15 VDC will be removed from the coil of K406. U418D is normally turned on by R458 to +15 VDC and when AR403-8 goes negative, current passes through the phototransistor of U418D which cause D426 and R465 to bias the comparator AR403C in a latched state. The low input to U419 is inverted twice providing a low to U421-6 allowing LED D221 (HV TRIP) to illuminate and turning on the phototransistor in U421C to provide a logic level output for external use.

The output of AR403C will stay low keeping K406 de-energized until the high voltage monitor output form PS101 is increased above the setpoint voltage at AR403-9 and S206 (TRIP RESET) is pressed. When S206 is pressed, the ground will turn off U418 allowing the output of AR403C to swing positive. The high output of AR403C will bias Q408 to conduct which will energize K406 removing the tripped condition. The high output of

AR403 will again be inverted twice by U419A and U420F to turn off U421C which will turn off LED D221 (HV TRIP).

2.2.3. Power Level Trips

The power level trips operate in a similar manner except that the monitored signal is applied to the negative input terminal of AR403A and AR403B so the trip occurs on an increasing signal.

2.3. TEST FUNCTIONS

s205

2.3.1 Power up Reset

There are five modes of operation - OPERATE, CAL HI, CAL LOW, CURRENT HV TEST. The mode is selected by pressing S202 (TEST/CALIBRATE) which steps decade counter U412 through successive test modes. When circuit power is applied, U413-9 will momentarily be at logic high until +15 VDC is discharged through C402 and R408. The logic high is twice inverted by UU413D and U413A to provide a logic high on U412-15 to reset the decade counter to its initial condition, placing the system in the OPERATE mode.

2.3.2. Time Delay Reset

u413-5

The Time Delay Reset circuit provides an automatic switching function to return the NMP-1000 to the OPERATE mode from any previously selected Test mode. The RC time constant of R473 and C424 connected to U423A-9, provide a reset delay of approximately 50 seconds. Selecting a test mode applies +15 V to U423-5. This provides a logic low to U423-1 which after inversion through U423A and U423F, discharges C424 through D430. R473 and C424 start recharging at U423-9 which will provide a logic low at U423-8 which is then inverted through U423C to provide a momentary high logic level on the normally held low input to U423B. This pulse is then inverted at U423-4 and applied to U413-1 as a momentary low logic pulse which is inverted to provide a logic high to the RESET input of U412-15. This will reset the Function Select Counter to the OPERATE condition.

2.3.3. Function Select Counter

The function select counter enables sequential selection of the TEST/CALIBRATE modes and OPERATE mode of the NMP-1000. Manual selection

s204

of each mode is accomplished by pressing the SELECT pushbutton in the TEST/CALIBRATE section of the front control panel. Pressing the SELECT (S202) pushbutton provides a +15 V high logic level to U413-5 which is inverted twice by U413C and U413B to provide a logic high to U412-14 (CLK). U412 advances one count for each positive transition (logic high) applied to the clock input. The count is internally decoded and appears as a logic high on the appropriate output pin Q0 to Q9.

The TEST/CALIBRATE or OPERATE modes are selected as the output of "OR" gates U414C (OPERATE), U414D (CAL HI), U415B (CAL LO), U414B (TEST CURRENT) and 414A (HV TEST). AS U412 is advanced. the Q0 through Q9 outputs provide a logic high to one input of one of the "OR" gates until the OPERATE mode is reselected.

The output of U414C (OPERATE) is applied as a logic high to U417A which is inverted to provide a ground to the OPERATE LED and also the U416D and U416E as +15 volts to arm the TRIP 1 and TRIP 2 alarm circuits. The output of U414D (CAL HI) is applied to hex invertors U413F to force the RANGE SELECT to 10^{-3}, and U413C to provide a ground to the CAL HI LED for illumination. U414D also provides the +15 volt source for the CAL HI test current. U415B provides the voltage source for the CAL LO test current and the input to LED driver U417D to illuminate the CAL LO LED. The output of U416B also is applied to "OR" gate U415A to force the RANGE SELECT switch circuit into the AUTO RANGE mode through U413E. The output of U414B (TEST CURRENT) provides the ground for the TEST CURRENT LED through U417B and an input to "OR" gate U415A to force the RANGE SELECT switch circuit into the AUTO RANGE mode through U413E.

U414B also provides +15 volts to the TEST CURRENT source. U414A provides the logic to illuminate the HV TEST LED through U413E and the bias to Q407 to test the HV Clamp circuit.

The four TEST/CALIBRATE modes are indicated by illumination of the appropriate LED in the TEST/CALIBRATE section of the front control panel. The OPERATE mode is indicated by the illumination of the OPERATE LED.

2.3.4. Test Current Sources

Three Test Current Sources are provided within the NMP-1000 for electrometer circuit operability checks. Two preset current sources are enabled during the CAL HI and CAL LO test modes. During the CAL HI test mode, the test current is approximately 1.2 milliamp and indicates

approximately 120 percent at 10^{-3} range on the POWER meter. Approximately +15 volts is applied through R654 and R655 to provide a current source to be applied to the electrometer input during CAL HI test mode. R655 adjusts the current source to provide the 1.2 mA input to the electrometer and D624 and D625 inhibit leakage current to the electrometer range selection circuit.

During the CAL LO test mode, the test current is approximately .2 milliamps and indicates approximately 20 percent at 10^{-3} range on the POWER meter. Approximately +15 volts is dropped through R644 and R645 to provide the non-adjustable .2 mA. D621, D622, D623 and D646 inhibit leakage current from entering the electrometer circuit during the test mode.

An adjustable current source is provided for the CURRENT test mode. This current source is adjustable from 10^{-11} amps to 10^{-3} amps for testing the AUTO RANGE select function and operability of all measurement ranges.

2.4. POWER SUPPLIES

2.4.1. High-Voltage Power Supply

The High-Voltage Power Supply (HVPS) is a flyback/ringing supply which alternately stores energy in a transformer core and converts the stored energy to a voltage by resonating the inductance of the transformer with its own shunt capacitance. The resulting waveform is rectified, filtered and fed back to a pulse wave modulator which functions as a regulation element. The output voltage is adjustable from 300 to 800 VDC with a total power consumption of 2.6 watts. The output is regulated to ±1 VDC with a maximum ripple of 1 mV P-P. R109 is used to adjust the output voltage.

2.4.2. Low-Voltage Power Supply

The secondary of T101 drops AC power to 18 VCT to power bridge rectifier D101 to D104 which provides +24 V unregulated to the High-Voltage Power Supply and the TRIP indicator LED's. The output of the bridge rectifier is applied to filters consisting of C101, C102, C103, R102 and R103 and regulated by VR101 to provide regulated +15 VDC. The secondary of T102 drops AC power to 36VCT which powers rectifier D105 and

D106. The output of the rectifier is filtered by R104, R105, C106 and C107 and regulated by VR102 to provide regulated -15V dc.

2.4.3. Compensating Power Supply

The secondary of T103 provides 200 volts to bridge rectifier D801 to D804 which is filtered and regulated by a shunt regulated bias supply for use in compensating ion chamber detectors. Output voltage from 0 to -150 V dc is adjustable by a 12-position selector switch (S2) for coarse adjustment; R210 is used for fine adjustment.

2.5. OUTPUTS AND ISOLATION DEVICES

2.5.1. Bistable Trip Outputs

The bistable trips are provided with two sets of normally open and normally closed relay contacts. Choice of alarm contact state (open or close on alarm) is left to the customer. Contact are rated at 0.6 A at 125 V ac or 0.6 A at 110 V dc. An optically isolated logic output for external monitoring of trip status with 5000 volt protection is provided for each bistable trip (U421b, U421C, and U421D).

2.5.2. Isolated Outputs

Two isolated power level outputs are provided with options to drive remote meters and recorders in a variety of configurations. Outputs corresponding to 0 to 120% full scale are available as 0 to 10 V dc and 4 to 20 mA while other output configurations can be optionally installed. The internal loop supply of AR1 and AR2 completely isolate the input loop from the output terminals and provide 1500 V RMS transient protection. Signal conditioning is accomplished through a modulator which converts the input voltage to a square wave that is passed through an isolation transformer and is demodulated and filtered to provide an output proportional to the input.

3. OPERATION

The following steps are routinely performed on operational equipment in normal installations:

1. Close S1 power ON switch. Green operate LED on front panel illuminates.

2. Press Test/Calibrate select (S5) button. Refer to Section 2 for correct sequence and modes.

3. Press RESET (S6) button.

4. Verify detectors signal lead is connected to J1 (SIGNAL INPUT); detector HV lead to J2 (HV OUT).

5. Verify output monitor devices are connected to the appropriate output port.

6. Repeat steps 1, 2, and 3 verifying outputs on monitoring devices.

7. Equipment is ready to operate.

4. NMP-1000 CALIBRATION/TEST PROCEDURE

4.1. LOW-VOLTAGE POWER SUPPLY TEST

1. Remove all PCB's from motherboard. Ensure that power switch S/F1 is in the off position. Connect the power cable to a 115 V ac, 60Hz power source.
2. Set the multimeter to read DC volts and connect the negative lead of the multimeter to a convenient ground on the NMP-1000 motherboard and the positive lead to TP9 (+24V).
3. Apply power to the NMP-1000 by placing the power switch S/F1 to the ON position.
4. Verify that the multimeter reads +24 V dc (± 5 V dc) and record on test results data sheet.
5. Connect the positive lead of the multimeter to TP10 (+15V) and verify that the multimeter reads +15 V dc (± 0.6 V dc) and record on test results data sheet.
6. Connect the positive lead of the multimeter to TP11 (-15V) and verify that the multimeter reads -15 V dc (± 0.6 V dc) and record on test results data sheet.
7. Remove power from the NMP-1000 by placing the power switch S/F1 to the Off position. Replace all of the PCB's that were removed in step 1.
8. Set the multimeter to read DC volts and connect the negative lead of the multimeter to a convenient ground on the NMP-1000 motherboard and the positive lead to TP9 (+24V)
9. Apply power to the NMP-1000 by placing the power switch S/F1 to the ON position.
10. Verify that the multimeter reads +24 V dc (±5 V dc) and record on test results data sheet.
11. Connect the positive lead of the multimeter to TP10 (+15V) and verify that the multimeter reads +15 V dc (± 0.6 V dc) and record on test results data sheet.
12. Connect the positive lead of the multimeter to TP11 (-15V) and verify that the multimeter reads -15 V dc (± 0.6 V dc) and record on test results data sheet.
13. Remove power from the NMP-1000 by placing the power switch S/F1 to the off position.

4.2. FRONT PANEL METER ADJUSTMENT

1. Remove the Analog PCB.
2. Set the DMM to read 1000 V dc and connect the positive lead to J2 (HV OUT) center conductor and the negative lead to the shield of J2.
3. Apply power to the NMP-1000 by placing the power switch S/F1 to the ON position.
4. Measure and record the high voltage.
5. Adjust R469 (HV METER ADJ), while watching the HV meter, to indicate the value recorded in step 4.
6. Connect the positive lead of the variable power supply to TP404 (%) on the Digital board and the negative lead to TP401 (GND).
7. Set the variable power supply at +10 V dc and adjust R471 to indicate full-scale deflection on the POWER meter.
8. Remove power from the NMP-1000 by placing the power switch S/F1 to the off position.
9. Remove power from the variable power supply and disconnect the leads from the NMP-1000.
10. Replace the Analog PCB that was removed in step 1.

4.3. ELECTROMETER CALIBRATION

1. Connect the current source to the SIGNAL INPUT jack J1 on the rear control panel of the NMP-1000.
2. Set the current source to provide an output of 12 pA to the SIGNAL INPUT of the NMP-1000.
3. Connect the multimeter positive lead to TP602 (0-10V and the negative lead to TP601 (GND) on the Analog board. Set the multimeter to read DC volts.
4. Apply power to the NMP-1000 by placing the power switch S/F1 to the ON position.
5. Set or verify the following initial conditions on the front control panel on the NMP-1000:

RANGE	10^{-11}
MANUAL CONTROL	LOCAL
COMPUTER CONTROL	OFF (LED not illuminated)
TEST/CALIBRATE	OPERATE
CURRENT ADJUST	FULL COUNTER-CLOCKWISE

<u>NOTE</u>

The TRIPS LED's may or may not be illuminated and will not affect the electrometer calibration section of this procedure.

<u>NOTE</u>

When adjusting the gain and offset of the lowest ranges in the following steps, it may be necessary to wait several minutes for the electrometer circuits to respond and stabilize.

6. Adjust R604 (10^{-11}) to indicate -10 ±0.01 V dc on the multimeter.
7. Set the current source for 0 current out and adjust R612 (OFFSET) to indicate 0.00 ±0.10 V dc on the multimeter.
8. Repeat steps 6 and 7 until no further adjustments are necessary.

9. Use the following table to set the input current to the NMP-1000 while selecting the appropriate range and adjusting the gain for that range.

Input	Range	Gain Pot.	Output TP602
120 pA	10^{-10}	R614 (-10)	-10 V dc ± 0.01
1.2 nA	10^{-9}	R618 (-9)	-10 V dc ± 0.01
12 nA	10^{-8}	R622 (-8)	-10 V dc ± 0.01
120 nA	10^{-7}	R626 (-7)	-10 V dc ± 0.01
1.2 uA	10^{-6}	R630 (-6)	-10 V dc ± 0.01
12 uA	10^{-5}	R634 (-5)	-10 V dc ± 0.01
120 uA	10^{-4}	R637 (-4)	-10 V dc ± 0.01
1.2 mA	10^{-3}	R640 (-3)	-10 V dc ± 0.01

10. With the current input set to 1 mA and the Range selected at 10^{-3}, connect the positive lead to TP402 (0-10V) and the negative lead to TP401 (GND). Verify that the multimeter indicates -10 ±0.01 V dc.
11. Connect the positive lead of the multimeter to TP403 (GAIN) and adjust R436 for 10 ± 0.01 V dc.
12. Remove power from the NMP-1000 by placing the power switch S/F1 to the off position.

4.4. AUTORANGE SWITCH POINTS

1. Turn R424 (UP LEVEL) fully clockwise and R416 (DOWN LEVEL) fully counter-clockwise.
2. Select 10^{-4} range on the NMP-1000 front control panel.
3. Set the current source to 108.0 uA.
4. Connect the positive lead of the multimeter to TP404 (% TEST).
5. Apply power to the NMP-1000 by placing the power switch S/F1 to the ON position.
6. Adjust the current source up or down as necessary until the multimeter indicates 9.00 V dc.
7. Select AUTO RANGE on the NMP-1000 front control panel.
8. Slowly adjust R424 (UP LEVEL) counter-clockwise until the NMP-1000 automatically switches to the next higher range (10^{-3}).
9. Set the current source to 80.0 uA.
10. Adjust the current source up or down as necessary until the multimeter indicates .667 V dc.
11. Slowly adjust R416 (DOWN LEVEL) clockwise until the NMP-1000 automatically switches to the next lower range (10^{-4}).
12. Remove power from the NMP-1000 by placing the power switch S/F1 to the off position.

4.5. TRIP SET POINTS

1. Turn R442 (TRIP 1) and R452 (TRIP 2) fully clockwise.
2. Set current source to 1.10 mA.
3. Select AUTO RANGE on the NMP-1000 front control panel.
4. Apply power to the NMP-1000 by placing the power switch S/P1 to the ON position.

NOTE

> Before continuing to the next step, observe that the NMP-1000 will auto range up to the 10^{-3} range and the POWER meter will settle at approximately 110%. If either TRIP LED is illuminated, press RESET and ensure that both TRIP 1 and TRIP 2 LED's go off.

5. Set the multimeter to measure resistance and check the status of the trip relay contacts as follows:

J4-24 to J4-22 - open	J4-24 to J4-20 - closed
J4-21 to J4-23 - open	J4-21 to J4-25 - closed
J4-18 to J4-16 - open	J4-18 to J4-14 - closed
J4-15 to J4-17 - open	J4-15 to J4-19 - closed

6. Slowly turn R442 (TRIP 1) counter-clockwise until the TRIP 1 LED on the NMP-1000 front control panel illuminates.
7. Set the current source to 1.20 mA.
8. Slowly turn R452 (TRIP 2) counter-clockwise until the TRIP 2 LED on the NMP-1000 front control panel illuminates.
9. Set the multimeter to measure resistance and check the status of the trip relay contacts as follows:

J4-24 to J4-22 - closed	J4-24 to J4-20 - open
J4-21 to J4-23 - closed	J4-21 to J4-25 - open
J4-18 to J4-16 - closed	J4-18 to J4-14 - open
J4-15 to J4-17 - closed	J4-15 to J4-19 - open

10. Press the RESET pushbutton on the NMP-1000 front control panel and observe that both TRIP 1 and TRIP 2 LED's remain illuminated.
11. Set the current source to 900 uA
12. Press the RESET pushbutton on the NMP-1000 front control panel and observe that both TRIP I and TRIP 2 LED's go off.

13. Set the multimeter to measure resistance and check the status of the trip relay contacts as follows:

J4-24 to J4-22 - open	J4-24 to J4-20 - closed
J4-21 to J4-23 - open	J4-21 to J4-25 - closed
J4-18 to J4-16 - open	J4-18 to J4-14 - closed
J4-15 to J4-17 - open	J4-15 to J4-19 - closed

14. Remove power from the NMP-1000 by placing the power switch S/F1 to the off position.

4.6 ISOLATION AMPLIFIER PCB ALIGNMENT

1. Set current source to 120 uA.
2. Select 10^{-4} range on the NMP-1000 front control panel.
3. Set the multimeter to read DC volts and connect the positive lead of the multimeter to J5-24 and the negative lead to J5-25.
4. Apply power to the NMP-1000 by placing the power switch S/F1 to the ON position.
5. Adjust R912 (GAIN 2) on the Isolation Amplifier PCB for an indication of 10 ±0.10 V dc on the multimeter.
6. Set the current source to standby (0 current out).
7. Observe an indication of 0.0 ±0.10 V dc on the multimeter.
8. Set the multimeter to read DC mA and connect the positive lead of the multimeter to J5-22 and the negative lead to J5-23.
9. Set the current source to 120 uA.
10. Adjust R902 (GAIN 2) on the Isolation Amplifier PCB for an indication of 20.0 ±0.10 mA on the multimeter.
11. Set the current source to standby (0 current out).
12. Observe an indication of 4.0 ±0.10 mA on the multimeter.
13. Remove power from the NMP-1000 by placing the power switch S/F1 to the off position.
14. Disconnect the current source and the multimeter from the NMP-1000.

4.7. COMPENSATION PCB

1. Set the multimeter to measure DC volts and connect the positive lead to the center pin of J3 on the NMP-1000 rear control panel. Connect the negative lead to the shield of J3.

WARNING

> High voltage exists within the compensation circuit. Care should be taken to avoid electrical shock.

2. Turn R110 (COMP ADJ) fully counter-clockwise.
3. Set S2 (on the NMP-1000 rear control panel) to position 1.
4. Apply power to the NMP-1000 by placing the power switch S/F1 to the ON position.
5. Observe an indication of 5.0 ±0.10 V dc on the multimeter.
6. Set S2 to position 10.
7. Adjust R110 (COMP ADJ) to indicate 150 ±1.0 V dc on the multimeter.
8. Remove power from the NMP-1000 by placing the power switch S/F1 to the off position.
9. Disconnect and remove the multimeter from J3.

4.8. HIGH-VOLTAGE POWER SUPPLY

1. Turn R462 (HV TRIP SET) fully counter-clockwise.
2. Apply power to the NMP-1000 by placing the power switch S/F1 to the ON position.

NOTE

If the HV trip LED is illuminated when the NMP-1000 is powered up, press the RESET pushbutton to reset the HV trip LED to off.

3. Set the multimeter to measure resistance and check the status of the trip relay contacts as follows:

J4-9 to J4-11 - open	J4-9 to J4-13 - closed
J4-12 to J4-10 - open	J4-12 to J4-8 - closed

4. While observing the HV meter on the NMP-1000 front control panel, adjust R109 (HV ADJ) for an indication of .7 (700 V).
5. Slowly adjust R462 (HV TRIP SET) clockwise until the HV trip LED illuminates.
6. Set the multimeter to measure resistance and check the status of the trip relay contacts as follows:

J4-9 to J4-11 - closed	J4-9 to J4-13 - open
J4-12 to J4-10 - closed	J4-12 to J4-8 - open

7. Press the RESET pushbutton on the NMP-1000 front control panel and observe that the HV trip LED remains illuminated.
8. While observing the HV meter on the NMP-1000 front control panel, adjust R109 (HV ADJ) for an indication of .8 (800 V).
9. Press the RESET pushbutton on the NMP-1000 front control panel and observe that the HV trip LED resets to off.
10. Set the multimeter to measure resistance and check the status of the trip relay contacts as follows:

J4-9 to J4-11 - open	J4-9 to J4-13 - closed
J4-12 to J4-10 - open	J4-12 to J4-8 - closed

11. Remove power from the NMP-1000 by placing the power switch S/F1 to the off position.

4.9. TEST/CALIBRATE FUNCTIONS

NOTE

The TEST/CALIBRATE function of the NMP-1000 has a feature which automatically resets the device back to the OPERATE condition after approximately 60 to 90 seconds. If the test is interrupted by the automatic reset, reselect the test mode and continue from the last completed step.

1. Apply power to the NMP-1000 by placing the power switch S/F1 to the ON position.
2. Select 10^{-3} on the NMP-1000 front control panel.
3. Set R201 (TEST CURRENT ADJUST) on the NMP-1000 front control panel fully clockwise.
4. Press the SELECT pushbutton in the TEST/CALIBRATE section of the NMP-1000 front control panel and observe that the CAL HI LED is illuminated.
5. Observe the following indications on the NMP-1000 front control panel:

OPERATE LED	off
CAL HI LED	on
CAL LO LED	off
CURRENT LED	off
HV TEST LED	off
POWER meter	120% at 10^{-3} range
TRIP 1 LED	on
TRIP 2 LED	on
HV TRIP LED	off
AUTO RANGE LED	off

6. Press the SELECT pushbutton and observe that the CAL LO LED is illuminated.
7. Observe the following indications on the NMP-1000 front control panel:

OPERATE LED	off
CAL HI LED	off
CAL LO LED	on
CURRENT LED	off
HV TEST LED	off
POWER meter	20% at 10^{-3} range
TRIP 1 LED	on
TRIP 2 LED	on
HV TRIP LED	off
AUTO RANGE LED	on

8. Press the RESET pushbutton on the NMP-1000 front control panel and observe that both TRIP 1 and TRIP 2 LED's reset to off.

9. Press the SELECT pushbutton and observe that the CURRENT LED is illuminated.

10. Observe the following indications on the NMP-1000 front control panel:

OPERATE LED	off
CAL HI LED	off
CAL LO LED	off
CURRENT LED	on
HV TEST LED	off
POWER meter	50% at 10^{-3} range
TRIP 1 LED	off
TRIP 2 LED	off
HV TRIP LED	off
AUTO RANGE LED	on

11. Slowly turn R201 (TEST CURRENT ADJUST) counter-clockwise while observing the POWER meter and the range indicator LED's for the following indications:

   a. The POWER meter will go down scale until the value is approximately 8%, at which point the range will be automatically switched to the next lower range. The POWER meter will then go up scale to approximately 80%.

   b. Continue to turn R201 (TEST CURRENT ADJUST) slowly counter-clockwise until the POWER meter has reached 0% and the RANGE indicator LED for 10^{-11} has illuminated.

   c. The POWER meter and range indicator LED's will continue to indicate down scale automatic switching until the TEST CURRENT ADJUST control is fully counter-clockwise.

12. Slowly turn R201 (TEST CURRENT ADJUST) clockwise while observing the POWER meter and the range indicator LED's for the following indications:

   a. The POWER meter will go up scale until the value is approximately 108% at which point the range will be automatically switched to the next higher range. The POWER meter will then go down scale to approximately 11%

   b. Continue to turn R201 (TEST CURRENT ADJUST) slowly clockwise until the POWER meter has reached 120% and the RANGE indicator LED for 10^{-3} has illuminated.

c. The POWER meter and range indicator LED's will continue to indicate up scale automatic switching until the TEST CURRENT ADJUST control is fully clockwise.

13. Press the SELECT pushbutton and observe that the HV TEST LED is illuminated.

14. Observe the following indications of the NMP-1000 front control panel:

OPERATE LED	off
CAL HI LED	off
CAL LO LED	off
CURRENT LED	off
HV TEST LED	on
POWER meter	n/a
TRIP 1 LED	off
TRIP 2 LED	off
HV TRIP LED	on
AUTO RANGE LED	on

15. Press the RESET pushbutton on the NMP-1000 front control panel and observe that the HV TRIP LED remains illuminated.

16. Press the SELECT pushbutton and observe that the OPERATE LED is illuminated.

17. Observe the following indications on the NMP-1000 front control panel:

OPERATE LED	on
CAL HI LED	off
CAL LO LED	off
CURRENT LED	off
HV TEST LED	off
POWER meter	n/a
TRIP 1 LED	off
TRIP 2 LED	off
HV TRIP LED	on
AUTO RANGE LED	off

18. Press the RESET pushbutton on the NMP-1000 front control panel and observe that the HV TRIP LED is reset to off.

19. Remove power from the NMP-1000 by placing the power switch S/F1 to the off position.

5. MAINTENANCE AND DRAWINGS

ENGINEERING DRAWINGS

1. Schematic
2. PCD assemblies (7)
3. Module assembly

NOTE: Additional pages redacted due to reasons 5.a and 5.b.