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Existing Relay Network Interface (ERNI)

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WARNING

Failure to observe this precaution may result in damage to the equipment or personal injury and may affect the equipment warranty.



It is recommended that the user of this equipment become acquainted with the following information before energizing the ERNI Systems and associated assemblies, or placing the equipment into service.

The ERNI is shipped in one packing carton if not supplied as part of a complete relay system. Care should be taken when opening to ensure that the equipment is not damaged or scratched.

Electrostatic discharge precautions should be observed when handling modules or individual components.

Read the Installation and Operation section thoroughly; then perform the Acceptance Tests before installing the ERNI in the network.

1. APPLICATIONS

The ERNI (see [Figure 1](#)) allows the user to monitor solid state and electro-mechanical relay operations in a power substation. It uses the same INCOM network as newer communications-based products, e.g., MDAR, MMCO or DPU. An IMAC substation controller, or PC operating thru a MINT translator, is also required to control the network and access data within the ERNI. The ERNI time tags and stores relay operations until the network is ready to receive the data.

Each of ERNI's four inputs (see [Table 1](#)) can monitor either circuit closing or circuit opening contacts and voltages with better than 2 ms time tagging resolution. (The monitored contact must have potential across it when in the open state). Time tagging for each event is synchronized to the interrogating device (i.e., IMAC or external PC). Up to 50 events can be stored in the ERNI before older data is written over with new events. Each event can be stored for a maximum of 55 days before being automatically deleted. Installation is greatly simplified as contact multipliers are not required.

All possible contingencies which may arise during installation, operation or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding this particular installation, operation or maintenance of this equipment, the local ABB Power T&D Company Inc. representative should be contacted.

An ERNI application need not be limited to relays. Door switches, station annunciator alarms, or contacts from any other device may be monitored.

2. CONSTRUCTION

The ERNI is a microprocessor-based device, consisting of four sub modules which make up an assembly. Mounted in a steel case, the four modules are:

- Front Panel module
- Analog module
- Digital module
- Surge protection module

2.1 Front Panel Module

The Front Panel module contains the “ACTIVE” LED, two hexadecimal address switches (A_0 and A_1), the main input connector (green housing), and the ground stud (GND).

2.2 Analog Module

When facing the front panel, the Analog module connects to the left-hand side of the front panel pc board; it contains:

- A switching power supply that provides 20 Vdc to the Digital and Surge Protection modules.
- Four input contact buffers that optically-isolate the relay connections from the Digital module. Each input buffer can operate with “wet” contact voltages thru the battery range from 48 to 250 Vdc, or 120 Vac.

2.3 Digital Module

When facing the front panel, the Digital module connects to the right-hand side of the front panel pc board; it contains:

- A microcontroller
- A RAM chip for holding target data
- An INCOM chip (proprietary) used to handle all network communications
- A linear regulator that converts 20 Vdc from the Analog module to 5 Vdc for the Digital module.
- Two user-adjustable components are contained on this module: a 4-position DIP switch which sets the contact input state (NO or NC) to be registered as an event, and a jumper that

represents the most-significant bit of a hexadecimal scheme for the ERNI address (0 or 1).

2.4 Surge Protection Module

The Surge Protection module connects directly to the Input pc board; it contains surge protection circuitry for the contact inputs, power supply, and communications network. It also contains the network interface transformer.

3. SPECIFICATIONS

3.1 Power Requirements

Range: For 48, 60, 110, 125, 220 and 250 Vdc batteries or 120 Vac

Burden:

Standby: 0.8 W @ 48 Vdc
1.4 W @ 125 Vdc
3.6 W @ 250 Vdc or 120 Vac

Transmitting: 2.0 W @ 48 Vdc
3.2 W @ 125 Vdc
5.3 W @ 250 Vdc or 120 Vac

3.2 Contact Inputs

Range: For 48, 60, 110, 125, 220 and 250 Vdc batteries or 120 Vac

Burden: 3.0 mA @ 48 Vdc
4.0 mA @ 125 Vdc
4.2 mA @ 250 Vdc or 120 Vac

3.3 Contact Input Characteristics

Since ERNI can be set to record either contact openings or closings, it is convenient to refer to the state of interest as “active.” For example, if the ERNI is set to record contact closures, then a target is created when the contact moves from open to closed (i.e., changes from inactive to active).

3.4 Timing

To prevent ERNI from storing multiple targets due to contact bounce, contacts must be active for 3.3 msec or longer to create a new target, and inactive for at least 17.78 msec to be considered OFF.

- minimum active time: 3.3 msec
- minimum inactive time: 17.78 msec

3.5 Voltage Levels

Contact input voltages less than 10 V are recorded the same as no voltage; voltages greater than 38V are recorded as high, and voltages between 10 and 38V are undefined.

- maximum low input voltage: 10 Vdc
- minimum high input voltage: 38 Vdc
- maximum high input voltage: 280 Vdc

3.6 Ambient Temperature Range

For Operation -0°C to +50°C
 For Storage -20°C to +80°C

Insulation Test Voltage 2.8kV, dc, 1 minute (ANSI C37.90.0, IEC-255-5)

Impulse Voltage Withstand 5kV Peak, 1.2/50 microseconds, 0.5 Joule, (IEC-255-5)

Surge Withstand Voltage 2.5kV, 1 MHz (ANSI C37.90.1, IEC-255-6)

Fast Transient Voltage 5kV, 10/150 ns Withstand (ANSI C37.90.1)

EMI Volts/Meter Withstand 25 MHz-1GHz, 10V/m Withstand (Trial use/ANSI C37.90.2).

Dimensions and Weight of Chassis (see **Figure 1**):

Height 5.26" (133.6 mm)
 Width 3.32" (84.3 mm)
 Depth 5.92" (150.4 mm)
 Weight 2.0 lbs. (0.9 kg)

External Wiring : 14 AWG stranded (max.)

4. INSTALLATION AND OPERATION

Installation and operation of the ERNI involves three steps:

- Set the ERNI address
- Set the internal and external adjustments
- Physically mount and connect the ERNI (see **Figure 1**, ERNI Outline Drawing.)

NOTE: During installation and operation, observe the following “ACTIVE” LED indications:

Green – flashes slowly for power “ON” when ERNI is passing all of its self-tests

Amber – flashes rapidly for hardware malfunction.

Red – flashes rapidly or constantly during transmission, depending on the number of messages.

NOTE: LED may be off during certain failure modes.

4.1 ERNI Address Settings

Each network device (e.g., the ERNI) must have a unique network address. On the ERNI front panel are two blue and white switches designated as A₀ and A₁. The hollowed-out arrow in the white circle, at the center of each switch, points to a single digit (a number from 0 to 9 or a letter from A to F) indicating the following values.

Single Digit	Digit Value
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15

In order to compute the ERNI address, represented by the settings of switches A₀ and A₁, it is necessary to add the digit value of A₀ to 16 times the digit value

of A_1 . For example, if A_0 is set at "B" and A_1 is set at "9", the address is $11 + (9 \times 16) = 155$. Furthermore, if A_0 is set at "F" and A_1 is set at "F", the address becomes $15 + (15 \times 16)$ or 255 (which is the highest address that can be obtained, using just the A_0 and A_1 switches).

The internal A2 jumper (when removed) can be used to add 256 additional addresses. For example, if A_0 and A_1 are both set at "F", and A2 is removed, the address becomes $15 + (15 \times 16) + (1 \times 256) = 511$. When A2 is installed, the address is represented as 0XX, where each X can be a digit from 0 to F.

In summary, the ERNI addresses are computed from the following values ($A_2 + A_1 + A_0$):

A2	A1	A0
<u>Jumper</u>	<u>Switch</u>	<u>Switch</u>

0 or 1 (x 256) 0 thru 15 (x 16) 0 thru 15 (x 1)

4.2 Setting External Address Switches

On the ERNI front panel are two hexadecimal (HEX) switches (A_0 and A_1), that are used to set the ERNI address (see 4.1). If an address higher than 255 is required, change the internal jumper (A2) setting to "1" (see 4.3.3 e for procedure).

To set the address, use a small screwdriver and move the HEX switch arrows (A_0 then A_1 , if required) to the appropriate setting (0 through F). When selecting addresses for your network, try starting with lower addresses, increasing as you add network devices. This technique will help speed up the IMAC substation controller when it is learning the network configuration.

4.3 Setting Internal Adjustments

The ERNI contains two user adjustments:

- A 4-position DIP switch
- A jumper

4.3.1 DIP Switch Adjustment

The 4-position DIP switch (SW1) selects the contact states that ERNI monitors; the four positions may be set in any combination of closings and openings:

a. With position closed (or ON), ERNI detects the application of voltage at its input.

b. With position open (or OFF), ERNI detects the removal of voltage at its input.

The four DIP switch positions are normally set at the factory in the OFF (or OPEN) position.

4.3.2 Jumper Adjustment

The A2 jumper is installed at the factory so that all addresses are represented by 0XX; the designation XX being the address selected on the HEX switches, A_0 and A_1 (see 4.1, above). Remove the jumper for all address from 100 thru 1FF.

4.3.3 Changing Internal Adjustment(s)

In order to change either the DIP switch or jumper adjustment, perform the following steps:

- a. Make sure that power is disconnected.
- b. Open the ERNI by removing the four screws at the left and right sides of the ERNI.

NOTE: It is not necessary to remove the two front panel screws.

CAUTION

When opening the ERNI or when handling ERNI out of its case, appropriate electrostatic discharge procedures should be followed.

c. Using thumb and forefinger, slide the ERNI out of its enclosure (case).

d. The DIP switch (SW1) is located on the right-hand PC Board, at the top and rear, away from the front panel. The four DIP positions are numbered 1, 2, 3 and 4; corresponding to their respective contact inputs. To monitor the presence of voltage on a contact input, lower the DIP switch (to the "ON" or CLOSED position); to monitor a loss of voltage, raise the DIP switch (to the "OFF" or OPEN position).

e. The A2 jumper also is located on the right-hand PC Board, near the lower edge of the board but nearer to the Front Panel. To set the ERNI address to 1XX remove the jumper from the two pins on the PC Board and place it on just one of the pins so that it hangs off to the side; this opens up the connection but allows you to keep the jumper for future changes. If the ERNI must be set back to 0XX, simply replace the jumper so that it connects the two pins on the board.

f. When internal adjustments are completed, slide the ERNI back into its case, and replace the four screws.

4.4 Mounting and Connecting ERNI

The ERNI should be mounted near the contacts that it monitors; the location should be free from dirt, moisture, excessive vibration, corrosive fumes, and heat.

The optional mounting bracket kit, 9656A94G01, (see [Figures 3](#) and [4](#)) can be used to attach ERNI directly to the rear of an FT-case.

Connect the ERNI as follows:

- a. Connect the ERNI “GND” (silver stud on the Front Panel) to substation ground.
- b. Connect the male connectors (surrounded by green casing) as follows:

- 1) INCOM (pins 1 and 2). Connect to network device (via shielded twisted pair) and, eventually, to IMAC or MINT

NOTE: The INCOM cable shield should not be grounded to ERNI.

- 2) IN 1 (pins 3 and 4) - Connect to any network relay contact or other device to be monitored, using shielded twisted pair. (Refer to [Figure 5](#) for typical connections.)

NOTE: The shield lead should be connected to substation ground (at silver stud), for all inputs. The remote end of the shield should not be grounded.

To prevent false targets when monitoring non-isolated AC, make sure that contacts connect the ERNI to the AC “HOT” side.

- 3) IN2 (pins 5 and 6) - (same as IN1 connection, above).
- 4) IN3 (pins 7 and 8) - (same as IN1 connection, above).
- 5) IN4 (pins 9 and 10) - (same as IN1 connections, above).
- 6) POWER ac/dc - Connect to station battery or 120 Vac source.
- 7) GND (substation ground) - This pin is connected (internally) to the silver stud.

5. ACCEPTANCE TESTS

It is recommended that the user perform specified Acceptance Tests on ERNI, *prior* to installing ERNI in the network, in order to verify that all circuits are operating properly. Before performing the Acceptance Tests, the user should be familiar with I.L. 604 (the IMAC software package, a subset of the WREL-COM family, Version 1.0 or higher), or the WREL-COM software package.

5.1 Preliminary Settings

Set the ERNI to a unique network address, using the external HEX switches *and* the internal jumper.

5.2 ERNI Self Test

Apply station battery to “POWER AC/DC” terminals (11 and 12); either polarity is acceptable. Within about 5 seconds, the “ACTIVE” LED should begin to slowly flash **green**, for about one second, and then one second off, etc. This indicates that ERNI is passing all internal self tests. If the LED begins to flash amber, there is an internal hardware fault.

NOTE: The ERNI self test cannot detect all internal faults. If the LED does not light, it is likely that the ERNI is not receiving power.

5.3 Network Test

Normally, the ERNI LED slowly flashes **green** prior to a network transmission. When ERNI responds to a network command, the LED flashes **red**; if the transmission is lengthy, the LED will remain red longer.

5.3.1 IMAC as the Controller

Connect the ERNI “INCOM” terminals (1 and 2) to the IMAC “INCOM” terminals (5 and 6), using shielded twisted pair wire. Place the IMAC controller in the Learn mode and observe if the ERNI is detected. If the controller does not recognize the ERNI, recheck the ERNI address (HEX switches and jumper), and try again.

NOTE: Be sure that the Learn mode address is as high or higher than the ERNI address.

5.3.2 Mint as the Controller

Connect the ERNI “INCOM” terminals (1 and 2) to the MINT “INCOM” terminals, using shielded twisted pair wire. The MINT’s RS232C serial port may be

connected to a modem or a PC; refer to the WRELCOM Software Manual for the correct cable configurations.

Follow the procedures in the WRELCOM Software Manual to establish communications between the PC (or modem) and ERNI. Execute several commands to ensure that the ERNI is operating properly.

5.4 Contact Input Test

With the ERNI attached to the network (contacts 1 and 2) place the IMAC controller in Interactive mode, and select the new ERNI. Request the contents of buffer 1; the controller should report no targets available. Now apply a voltage (between 38 and 280 Vdc), using either polarity, between each contact input pair (i.e., across terminals 3-4, 5-6, 7-8, 9-10); this simulates relay activity. Use the network controller to request the contents of buffer 1 (again)

and observe any new targets. Each of the four inputs should have created at least one target.

If a MINT translator is used instead of the IMAC, follow the software instructions for communicating with ERNI, and use the following test procedure:

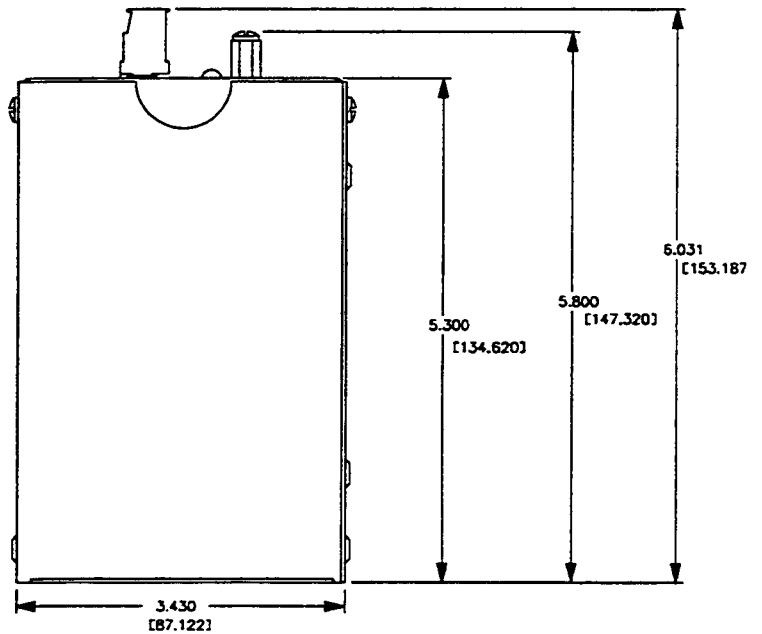
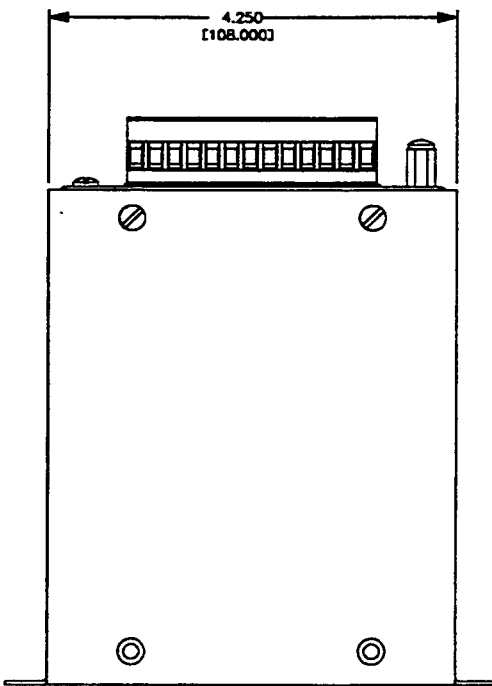
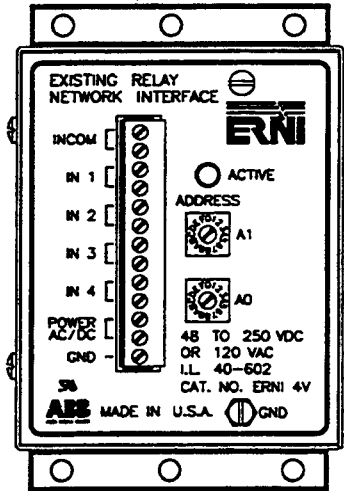
Step 1: Connect the INCOM cable between the MINT and ERNI.

Step 2: Connect the PC to the 25 pin RS232C port on the MINT.

Step 3: Load and run WRELCOM software in the PC.

During the contact input test, the LED flashes green (slowly). When the contents of buffer 1 are requested, the LED flashes red.

Front Panel



Sub 2
1610C99

Figure 1. ERNI Front Panel and Outline Drawing

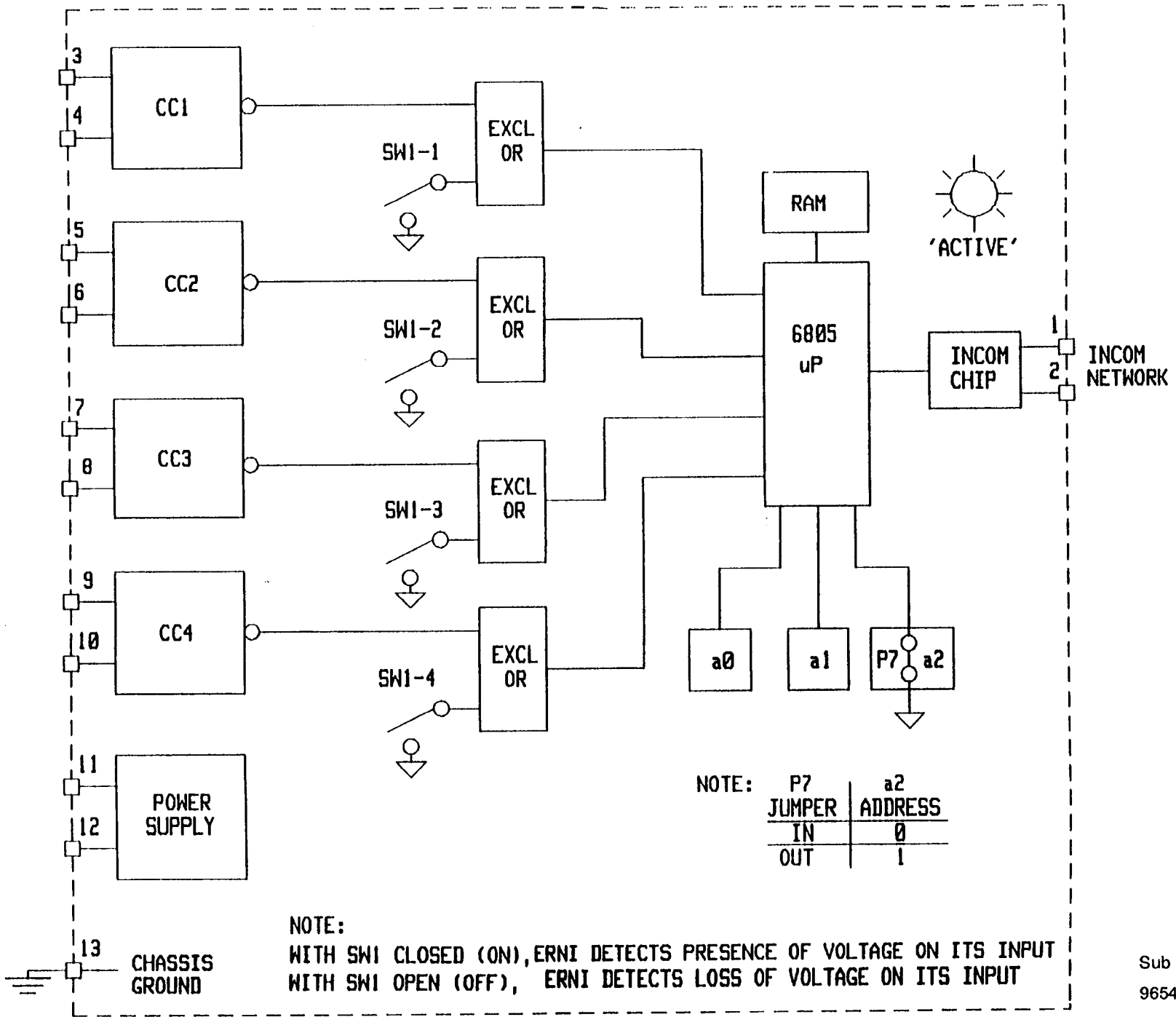
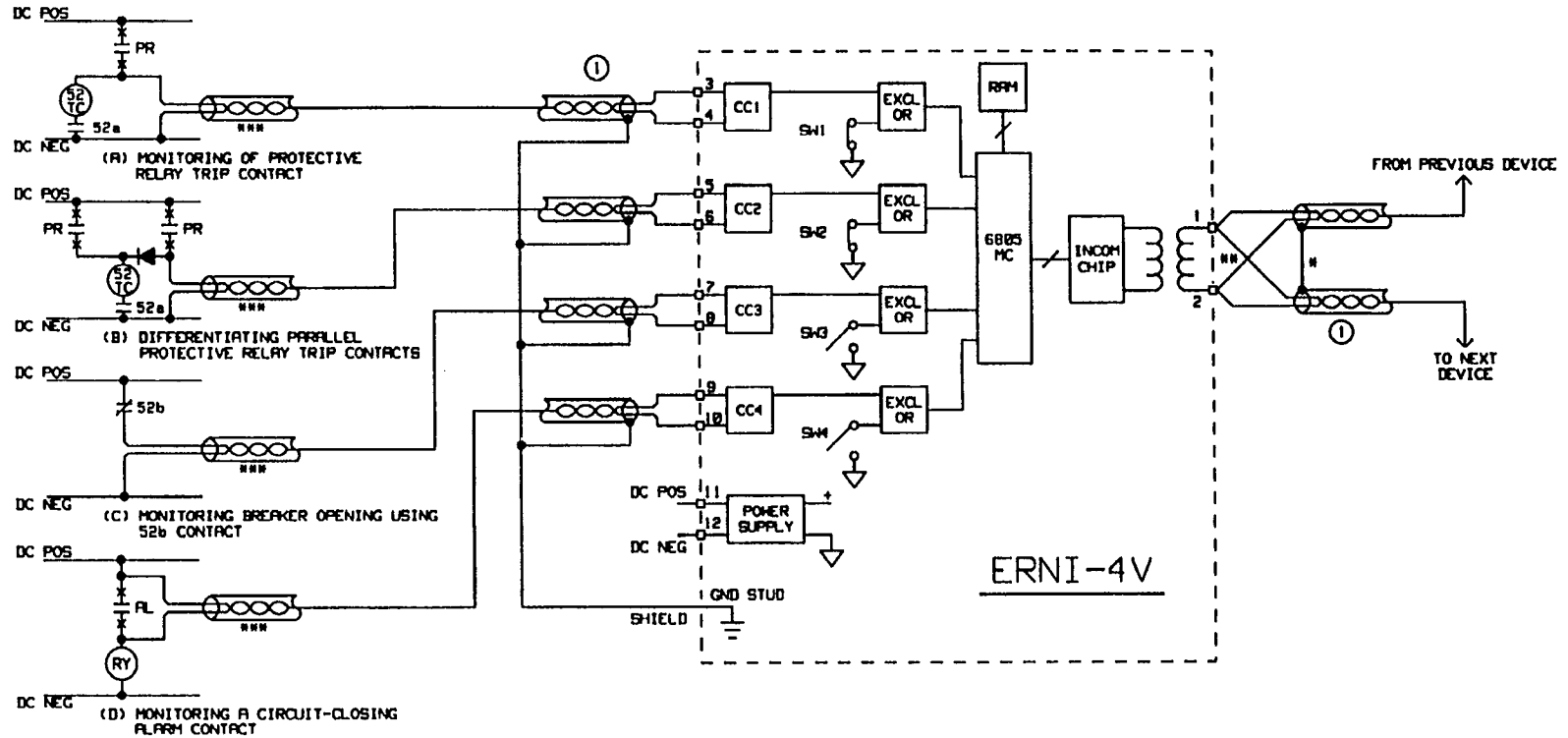


Figure 2. ERNI Block Diagram



- * INCOM SHIELDS SHOULD BE CONNECTED THROUGH AND NOT GROUNDED AT THE DEVICE. GROUNDED SHOULD BE MADE AT THE IMAC OR MINT.
- ** THE LAST INCOM DEVICE IN THE NETWORK SHOULD CONTAIN A 150 OHM, 1/2 WATT, CARBON COMPOSITION RESISTOR ACROSS THE 2 NETWORK TERMINALS.
- *** SHIELDS SHOULD NOT BE GROUNDED AT THIS END.
- ① STANDARD PAIRED SHIELDED COMMUNICATION AND INSTRUMENTATION CABLE, 18 TO 24 GAUGE.

* Sub 2
9655A75

Figure 5. ERNI External Connection Diagram

* Denotes Change

TABLE 1. ERNI CATALOG NUMBER

EXISTING RELAY NETWORK INTERFACE	Typical Catalog Number *		
	<u>E</u> <u>R</u> <u>N</u> <u>I</u>	4	V
4 CONTACT INPUTS	4		
VOLTAGE INPUTS	V		

* SEE DRAWING