



Type MRC Multishot Reclosing Relay

Effective: May 1992

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CAUTION

It is recommended that the user of this equipment become acquainted with the information in this instruction leaflet before energizing the relay. Failure to do so may result in injury to personnel or damage to the equipment, and may affect the equipment warranty.

The relay contains static sensitive components. Electrostatic Discharge (ESD) precautions must be practiced when handling printed circuit boards and components. Use of anti-static handling materials and grounding procedures is required.

Before putting relay into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment. Operate the relay to check the settings and electrical contacts.

The operation of this relay is based on ABB proprietary software, resident-in-memory components. Purchase of this relay includes a restrictive licence for the use of any and all programs solely as part of the protective functions. ABB reserves the right to request return of the memory components should the relay no longer

be used as a protective device. The programs may not be copied, transferred or applied to any other device.

1. APPLICATION

The MRC reclosing relay is used for automatic reclosure of ac or dc electrically operated circuit breakers after they have been opened by overcurrent or other protective relay action. The basic style operates with 48 or 125 Vdc, or 120 Vac (50 or 60Hz) input control voltage. The relay may be adjusted to provide several reclosures at predetermined intervals, so that in case the breaker does not remain closed after the first reclosure additional reclosures will be made. The first reclosure usually is an immediate reclosure. System operating experience has shown that the majority of faults are of a temporary nature, such as lightning flashovers, and will not be reestablished after an interruption of the fault current. Consequently, service interruption can be minimized by the use of an immediate reclosure. However, the first reclosure may be delayed if desired.

In case the circuit breaker does not remain closed after the first reclosure, the relay will make additional reclosures at suitably graded intervals. It is common practice to make two additional reclosures, but the relay may be adjusted to make any number up to a total of four reclosures if desired. If the breaker does not remain closed after the final reclosure, the relay goes to "LOCKOUT", and any further attempts at reclosure must be made by manual operation of the external customer control switch. However, if the breaker remains closed after any automatic reclosure, the relay will advance to and stop at the "HOME" position, where the relay is in readiness for another cycle of automatic reclosures following the next tripping of the breakers.

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.

For any automatic reclosing application, the underlying factors for breaker interrupting ability should be checked when choosing any particular reclosing cycle. Also, when using immediate first reclosure, it is necessary that the protective relays open their contacts before the breaker contacts make again. Note that the A03 style of the MRC has an intentionally long-time delayed release of the closing relay to accommodate special breaker control schemes.

2. CONSTRUCTION

The MRC is a microcontroller-based multishot reclosing relay designed to fit into an FT-21 flexitest case (Figure 1). It monitors an optically-isolated 52b contact input, and provides contact outputs using board-mountable, covered relays. Timing, counting and logic are determined by the microcontroller. The relay consists of three printed circuit (pc) modules:

- Input/Output
- Microcontroller/Display
- Power Supply

2.1 Input/Output Module

The opto-isolator (for 52b contact input) is jumper-selectable for operations with 48 Vdc, 125 Vdc, 250 Vdc, 120 Vac and 240 Vac.

There are three pc board-mountable relay outputs:

- Alarm relay
- Close relay
- Instantaneous trip lockout relay

The alarm relay is jumper-selectable for normally-open (N.O.) or normally-closed (N.C.) alarm contacts. The close relay and instantaneous trip lockout relay are not jumper-selectable.

2.2 Microprocessor/Display Module

This module consists of an Intel 8751 single chip 8-bit microcontroller with 4K bytes of EPROM program memory, an EEPROM for data retention, a micromonitor IC chip for monitoring the 5 Vdc power supply, the software execution and microcontroller controlled start-up. A 2-line, 16-character per line, liquid crystal display (LCD) with 5 x 7 (dots) charac-

ter size is used for displaying the sequence of relay operation, including timing and failure mode, as well as settings. There are 4 indication leds: "POWER", "FAILED RECLOSE", "HOME", and "LOCKOUT"; 4 pushbuttons for setting data entries; and 2 reset switches (one FAILED RECLOSE RESET which is externally accessible, and one on-board MICROCONTROLLER RESET).

2.3 Power Supply Module

There is an isolated switching power supply, capable of supplying +5 Vdc for microcontroller and surrounding IC logic, -5 Vdc for the LCD display, and 24 Vdc for the output relays.

2.4 Specifications

The MRC conforms to Industry Standards: ANSI C37.90 and C37.90.1.

- a. Inputs: Optically-isolated inputs suitable for 48 Vdc, 125 Vdc, 250 Vdc, 120 Vac, and 240 Vac. One input is available for 52b. Terminals 7 and 8 are used (Figure 2).
- b. Outputs: The MRC relay provides the following contact outputs:
 - Monitor alarm: N.O. or N.C. contacts selectable through jumpers; terminals 5 and 6 are used (Figure 2).
 - Close 1: N.O. contacts terminals 1 and 2 are used (Figure 2).
 - Instantaneous trip from lockout: (ITLO): N.O. contacts; terminals 3 and 4 are used (Figure 2).

If the close contacts interrupt inductive loads carrying 0.4 amps or greater, a Zener diode type 1.5KE300 (style number 878A619H07) should be connected in parallel with the interrupted coil to protect the close contacts.

- c. Power Supply: Isolated dc/dc with ac and dc source capability. One style includes 48/125 Vdc, and 120 Vac power supply. Terminals 9 and 10 are used (Figure 2).

3. OPERATIONS

3.1 Front Panel

The MRC front view (Figure 1) includes a display with led indicators, and pushbutton controls.

3.1.1 Front Panel Display

- a. LCD 2-line display with 16 characters per line, for displaying functions and values.
- b. POWER led is "ON" for normal, "OFF" or "blinking" for trouble (red). Used as monitor alarm.
- c. LOCKOUT led (amber). Uses the LCD display.
- d. FAILED RECLOSE led (amber).
- e. HOME led (red). Uses the LCD display.

3.1.2 Push-Button Operation

- a. SELECT/RUN push-button.
- b. LOWER push-button for scrolling functions and values.
- c. RAISE push-button for scrolling functions and values.
- d. SET/ENTER push-button for updating values.
- e. FAILED RECLOSE RESET push-button for external access.

3.1.3 Front Panel Settings

The following functions may be scrolled-thru and/or set using the LCD Screen (See Block Diagram, Figure 4).

- Maximum cycle timer and reclose fail timer need to be enabled in order to display them.

3.2 Operating Procedures

- a. The procedure to change functions and values is as follows (See Figure 1):

NOTE: Functions can be scrolled or changed only when the LCD message shows either "HOME" or "LOCKOUT".

- 1) Push the SELECT/RUN button. "Select Mode" will appear momentarily on the LCD screen. The HOME led goes out if relay is "HOME". The following message appears on the LCD screen:

LCD Message

```

STYLE *
VER 01      8/31/88
* Appropriate style
  number is displayed
    
```

```

RECLOSURES
      4
    
```

- 2) Push the SET/ENTER button. The following message will appear on the LCD screen as long as the SET/ENTER button is held down:

```

SET VALUE
      4
    
```

FRONT PANEL SETTINGS			MRC DISPLAYED FUNCTIONS		
	FUNCTION	VALUE			FACTORY SET TO
a.	RECLOSURES TO LOCKOUT	0 to 4	" RECLOSURES	"	4
b.	INSTANTANEOUS TRIP ENABLE	0 to 4	" INSTANT. TRIPS	"	1
c.	FIRST RECLOSE TIMER, sec	0 to 250	" FIRST RECLOSE	"	10
d.	SECOND RECLOSE TIMER, sec	0 to 250	" SECOND RECLOSE	"	15
e.	THIRD RECLOSE TIMER, sec	0 to 250	" THIRD RECLOSE	"	30
f.	FOURTH RECLOSE TIMER, sec	0 to 250	" FOURTH RECLOSE	"	30
g.	FOLLOW BREAKER	Yes or No	" FOLLOW BREAKER	"	No
h.	RESET TIMER, sec	0 to 250	" RESET	"	60
i.	INSTANTANEOUS TRIP FROM LOCKOUT	Yes or No	" IT FROM LOCKOUT	"	No
j.	FAIL RECLOSE ENABLE	Yes or No	" FAIL RECLOSE	"	Yes
k.	RECLOSE FAIL TIMER, sec	0 to 250	" RECLOSE FAIL	"	60
l.	MAX CYCLE ENABLE	Yes or No	" MAX CYCLE	"	No
m.	MAXIMUM CYCLE TIMER, sec	0 to 999	" MAXIMUM CYCLE	"	999

When the SET/ENTER button is released, the following message will appear on the LCD screen:

RECLOSURES

4

- 3) Scroll thru the values by pushing either the LOWER or RAISE button.

NOTE: Scrolling proceeds at a faster rate by continuing to hold down either the LOWER or RAISE button.

- 4) When the appropriate value is reached (e.g., value = 2), release the LOWER or RAISE button.
- 5) To display the original value, press the SELECT/RUN button, until the "VALUE UNCHANGED" message is displayed; then release the SELECT/RUN button. The relay remains in the select mode.
- 6) Push the SET/ENTER button to enter the value of 2.
- 7) Scroll and set other functions/values by pushing either the LOWER or RAISE button until the appropriate function is reached and repeating steps 2 thru 6.

- b. When the functions/values have been reviewed or modified as desired, press the SELECT/RUN button until the "HOME" message is displayed, then release the SELECT/RUN button. If the relay was in the "HOME" state before the "SETTINGS" mode, the "HOME" led will turn ON and the relay will be operational.

4. FUNCTIONS

Press the SELECT/RUN button on the front panel to enter the select mode, so that the LOWER and RAISE buttons can be used to select a function (see 3.1.3 for functions).

4.1 Lockout

During power-up, the relay goes to the LOCKOUT state; any further relay reclosing operation is

inhibited, and the LOCKOUT led is lit. LOCKOUT occurs during any of the following conditions:

- a. The breaker opens (52b closes) after all programmed reclose attempts have expired.
- b. FAILED RECLOSE occurs (when enabled).
- c. INSTANTANEOUS TRIP FROM LOCKOUT is allowed and trip occurs. (Relay stays in LOCKOUT.)
- d. The pump count is exceeded.
- e. Max cycle is exceeded (when enabled).

4.2 Timers

4.2.1 Reset Timer

To enable this function, use the select mode and select a value from 0 to 250, in 1-second increments. The RESET timer is started when the 52b contacts open. If the breaker remains closed (52b contacts open) for the duration of the RESET timer setting, the relay will go to the "HOME" state. The "HOME" led is lit when the relay is in the "HOME" state. If the breaker reopens (52b contacts close), before the RESET timer expires, the relay will go to the next reclose attempt or to the "LOCKOUT" state.

4.2.2 Reclose Timer

The setting ranges are incremented as follows:

<u>Range</u>	<u>Increment</u>
■ from 0 -1 sec	in 0.01 sec
■ from 1 - 10 sec	in 0.1 sec
■ from 10-250 sec	in 1 sec

The RECLOSE timer is started when the 52b contacts close. At the end of the timing cycle, the Close 1 output contact is closed to energize the circuit breaker closing coil. Up to 4 RECLOSE timers are allowed. Setting any RECLOSE timer delays to 0 will initiate an immediate reclose (no intentional delay).

4.2.3 Reclose Fail Timer

To enable this function, use the select mode and answer "YES" to "FAIL RECLOSE". This function is initiated at the end of every RECLOSE timer delay. The "RECLOSE FAIL" timer value is adjustable and may be set (using the SET/ENTER button) from 0 to 250 seconds. If the set time is exceeded before the

breaker closes, the relay immediately goes to LOCKOUT. The FAILED RECLOSE led indicator is lit; in addition, the LOCKOUT led lights up and monitor alarm contacts close. To inhibit the RECLOSE FAIL timer, answer "NO" to FAIL RECLOSE enable.

4.2.4 Max Cycle Timer

This function is enabled by answering "YES" and is disabled by answering "NO" in the select mode to MAX CYCLE. Then scroll to MAXIMUM CYCLE timer and set the time period value. The time period (from the recognition of the first 52b contact closing until the relay is either reset or advanced to LOCKOUT) is from 0 to 999 seconds, in 1-second increments.

4.3 Instantaneous Trip From Lockout

This function is enabled or disabled by answering "YES" or "NO" in the select mode. The INSTANTANEOUS TRIP FROM LOCKOUT displayed as ("IT FROM LOCKOUT") function allows the breaker to trip instantaneously while the relay is in "LOCKOUT".

4.4 Follow Breaker (or 52b)

This function allows the relay to follow the 52b contacts action. While the relay is timing a reclosure, it checks the 52b contacts for openings. If the 52b contacts open, within a reclosure, the relay starts the "reset" sequence. If the 52b contacts close, within the "reset" sequence, the relay goes to the next reclosure (if more reclosures remain), or to "LOCKOUT". The "Follow Breaker" function, displayed as "FOLLOW BREAKER", is enabled or disabled by answering "YES" or "NO" in the select mode. When this function is enabled, a maximum of 4 trips to "LOCKOUT" are allowed.

4.5 Instantaneous Trip Enable

The INSTANTANEOUS TRIP ENABLE function, displayed as "INSTANT. TRIPS", causes the relay to close the INSTANTANEOUS TRIP ENABLE contact, and permits instantaneous tripping of the circuit breaker. Up to 4 instantaneous trips are allowed and selectable through the select mode.

4.6 Power-up to Last State Option

If the relay has this option, then upon loss of power for any period of time, the relay will store the

last state and timer contents. When the power is restored the relay will go back to the last state and resume the sequence starting at the time the power was lost.

5. ACCEPTANCE TESTS

5.1 Preliminary Steps

- a. Verify that jumper 1 on the I/O module is in the 125V position. Locate jumper 2 on the I/O module and verify that it is in the Normally Closed (N.C.) position.
- b. Locate jumpers 3 and 4 on the I/O module and verify that they are in the dc position.
- c. Make sure to follow step d to drive the MRC relay to a known state such as "HOME" or "LOCKOUT" before proceeding with the acceptance test.
- d. Set a variable source to 125 Vdc, then turn off the source and connect it to the relay: the positive lead to terminal 10 and the negative lead to terminal 9. Do not connect terminals 1 and 2 in order to disable the close relay (CR) output.
- e. Open the 52b contacts. Turn the relay ON. Wait until the relay goes "HOME".
- f. Turn the relay off. Close the 52b contacts. Connect the relay per figure 5.
- g. Turn the relay ON. During this initialization procedure, the POWER led will be OFF and other leds will be ON for approximately one second.
- h. At power-up, the MRC relay does a self check (a power check, a dead man check, and a three-out-of-three memory check). If the relay passes the self check, then the relay is going to assume the following status:

Led Status

POWER	ON
FAILED RECLOSE	OFF
HOME	OFF
LOCKOUT	ON

Relay Contact Status

Alarm Relay	Open
Close Relay	Open
Instantaneous Trip	
Enable Relay	Open

NOTE: Refer to the External Wiring Connections Diagram, in Figure 6, before proceeding further.

5.2 Open 52b Contacts (Breaker Closes)

When contact 52b opens, the RESET timer begins.

Led Status	
POWER	ON
FAILED RECLOSE	OFF
HOME	OFF
LOCKOUT	ON
LCD Message	
RESET	
5 Sec 60 Sec	
Relay Contact Status	
Alarm Relay	Open
Close Relay	Open
Instantaneous Trip	
Enable Relay	Open

5.2.1 Close 52b contacts (breaker opens) while the reset timer is still timing, the relay stays in LOCKOUT.

Led Status	
POWER	ON
FAILED RECLOSE	OFF
HOME	OFF
LOCKOUT	ON
LCD Message	
LOCKOUT	
Relay Contact Status	
Alarm Relay	Open
Close Relay	Open
Instantaneous Trip	
Enable Relay	Open

5.2.2 Manually open the 52b contacts (breaker closes). If the breaker remains closed while the RESET timer times out, the relay goes to "HOME".

Led Status	
POWER	ON
FAILED RECLOSE	OFF
HOME	ON
LOCKOUT	OFF
LCD Message	
HOME	
Relay Contact Status	
Alarm Relay	Open
Close Relay	Open
Instantaneous Trip	
Enable Relay	Closed

NOTE: When scrolling the functions, refer to Section 3.1.3.

5.3 Reclosing Sequence

MRC stays "HOME" until the 52b contacts close.

NOTE: Verify the "Factory Set To" values below (see also 3.1.3):

5.3.1 Successful Reclosures

Starting with the relay in "HOME" position, close the 52b contacts; the relay starts the first reclosure. Open the 52b contacts and leave them open; the relay goes to the reset sequence:

FRONT PANEL SETTINGS			MRC DISPLAYED FUNCTIONS		
	FUNCTION	VALUE			FACTORY SET TO
a.	RECLOSURES TO LOCKOUT	0 to 4	" RECLOSURES	"	4
b.	INSTANTANEOUS TRIP ENABLE	0 to 4	" INSTANT. TRIPS	"	1
c.	FIRST RECLOSE TIMER, sec	0 to 250	" FIRST RECLOSE	"	10
d.	SECOND RECLOSE TIMER, sec	0 to 250	" SECOND RECLOSE	"	15
e.	THIRD RECLOSE TIMER, sec	0 to 250	" THIRD RECLOSE	"	30
f.	FOURTH RECLOSE TIMER, sec	0 to 250	" FOURTH RECLOSE	"	30
g.	FOLLOW BREAKER	Yes or No	" FOLLOW BREAKER	"	No
h.	RESET TIMER, sec	0 to 250	" RESET	"	60
i.	INSTANTANEOUS TRIP FROM LOCKOUT	Yes or No	" IT FROM LOCKOUT	"	No
j.	FAIL RECLOSE ENABLE	Yes or No	" FAIL RECLOSE	"	Yes
k.	RECLOSE FAIL TIMER, sec	0 to 250	" RECLOSE FAIL	"	60
l.	MAX CYCLE ENABLE	Yes or No	" MAX CYCLE	"	No
m.	MAXIMUM CYCLE TIMER, sec	0 to 999	" MAXIMUM CYCLE	"	999

- Step 1. The Reset timer times out.
- Step 2. The relay goes "HOME".
- Step 3. The "HOME" led lights up and the "Home" message appears on the LCD screen.

NOTE: Value settings can be checked and/or entered while the relay is in the "LOCKOUT" or "HOME" state.

5.3.2 Four Time Delay Reclosures to Lockout

With the relay in "HOME" state, close the 52b contacts; the relay starts the first reclosure:

- The first reclosure times out.
- The Close 1 relay contacts close.

Open the 52b contacts momentarily, and then close them; the relay starts the second reclosure.

- The second reclosure times out.

Open the 52b contacts momentarily, and then close them; the relay starts the third reclosure.

- The third reclosure times out.

Open the 52b contacts momentarily, and then close them, the relay starts the fourth reclosure.

- The fourth reclosure times out.

Open the 52b contacts momentarily, and then close them; the relay goes to LOCKOUT.

- The LOCKOUT led lights up.
- The "LOCKOUT" message is displayed.

NOTE: The number of reclosures (0 to 4) and their respective timers (0 to 250 sec.) can be set while the relay is "HOME" or in "LOCKOUT".

5.3.3 Failed Reclose

This function is enabled or disabled by answering "YES" or "NO" (refer to Section 3.1.3).

- With the relay in "HOME", close the 52b contacts; the relay starts the first reclosure.

- The first reclosure times out.
- The Close 1 relay contacts close. Leave the 52b contacts closed; the failed reclose timer starts.
- The fail reclose timer times out, then the relay goes to "LOCKOUT". The "LOCKOUT" led and the "FAILED RECLOSE" led light up. The alarm relay closes. The "FAILED RECLOSE" message is displayed with the "LOCKOUT". The "FAILED RECLOSE" led can be reset by pushing the "FAILED RECLOSE RESET" button.

5.3.4 Lockout for Follow Breaker Option

Using the Front Panel settings, in Section 3.1.3, enable "FOLLOW BREAKER" by answering "YES".

With the relay starting from the "HOME" position, close the 52b contacts; the relay starts the first reclosure:

- Open the 52b contacts before the first reclosure times out; the relay starts to reset.
- Close the 52b contacts before the RESET timer times out; the relay goes to the second reclosure.
- Open the 52b contacts before the second reclosure times out; the relay starts to reset.
- Close the 52b contacts before the RESET timer times out; the relay goes to the third reclosure.
- Open the 52b contacts before the third reclosure times out; the relay starts to reset.
- Close the 52b contacts before the RESET timer times out; the relay goes to the fourth reclosure.
- Open the 52b contacts before the fourth reclosure times out; the relay starts to reset.
- Close the 52b contacts before the RESET timer times out; the relay goes to LOCKOUT. The LOCKOUT led turns on, the message "LOCKOUT" is displayed.

NOTE: This option is disabled by answering "NO" to "FOLLOW BREAKER" in the select mode.

5.3.5 Max Cycle

Set the "MAX CYCLE" function to "YES" (for test purposes only), and the MAXIMUM CYCLE TIMER to 8 sec.

- With the relay at "HOME", close 52b contacts; the relay simultaneously starts the FIRST RECLOSE TIMER and the "MAXIMUM CYCLE" timer.
- The FIRST RECLOSE timer times down to 1second, and the relay goes to "LOCKOUT". The "LOCKOUT" LED and the "FAILED RECLOSE" led light up. The "LOCKOUT" message is followed by the "MAX TIME EXPIRED" message.
- Open the 52b contacts and leave them open; the relay will go to reset and then "HOME".
- Reset the "FAILED RECLOSE" led by pushing the FAILED RECLOSE RESET button.

NOTE: Go to Front Panel Settings (Section 3.1.3) and disable the "MAX CYCLE" function by setting it to "NO".

5.3.6 Power-Up to Last State

If the relay has a Power-Up-to-Last-State Option, then check it as follows:

- With the relay in "HOME", close the 52b contact; the relay starts the first reclosure.
- Turn off the power to the relay somewhere in the middle of the timing sequence.
- Restore the power to the relay and observe that the relay resumes the reclosing sequence at the time the power was lost.
- Repeat the test for different reclosures, reset, and failed reclosures.
- Make sure to drive the relay "HOME" by opening the 52b before terminating the test.

6. INSTALLATION

6.1 Mechanical Installation

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture excessive vibration and heat. Mount the relays vertically by means of the four mounting holes on the flanges for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be used for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting, or with the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench. See Figure 15 for the Outline and Drilling Plan. For detailed FT Case information refer to I.L. 41-076. For mounting hardware information, see Technical Data sheet No. 41-020.

WARNING

If the relay to be installed has a Power-To-Last-State Option, make sure to use steps a through e in section 5 before connecting all the inputs and outputs of the relay.

6.2 Electrical Wiring

(See Figure 6.)

LIST OF FIGURES

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Figure 4	Functional Block Diagram	Drawing #1499B22
Figure 5	Overall Schematic Type MCR Relay	Drawing #1355D46
Figure 6	External Schematic FT-21 Version	Drawing #1609C87
Figure 7	Component Location I/O Module	Drawing #1498B10
Figure 8	Internal Schematic I/O Module	Drawing #1608C81
Figure 9	Component Location Display/Processor Module	Drawing #1498B08
Figure 10	Internal Schematic Display/Processor Module	Drawing #1608C79
Figure 11	Component Location Power Supply Module	Drawing #1498B11
Figure 12	Internal Schematic Power Supply	Drawing #1608C83
Figure 13	Component Location Extender Board	Drawing #1499B03
Figure 14	Internal Schematic for the Extender Board	Drawing #1499B04
Figure 15	MRC Mounting in FT-21 Case	Drawing #57D7901

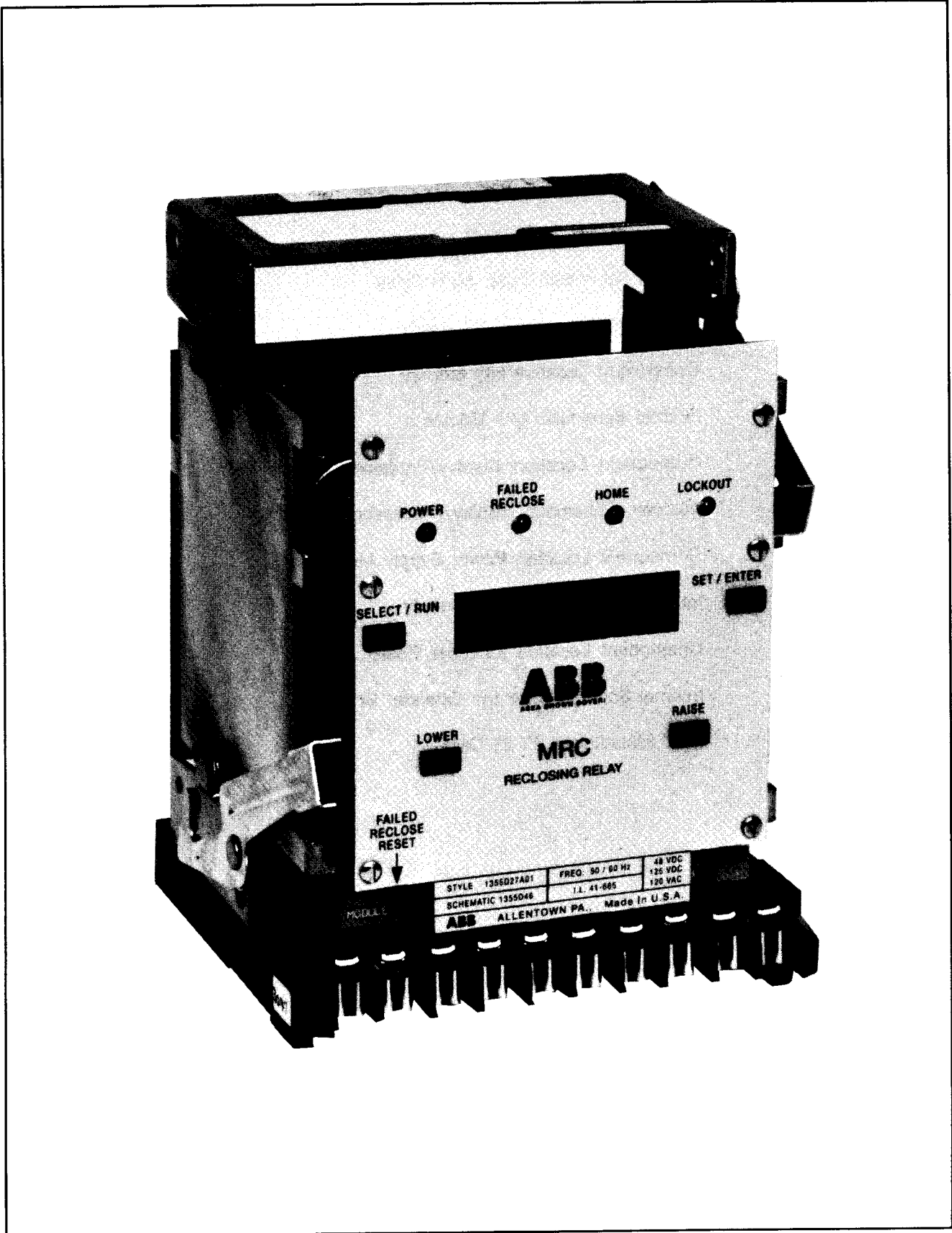
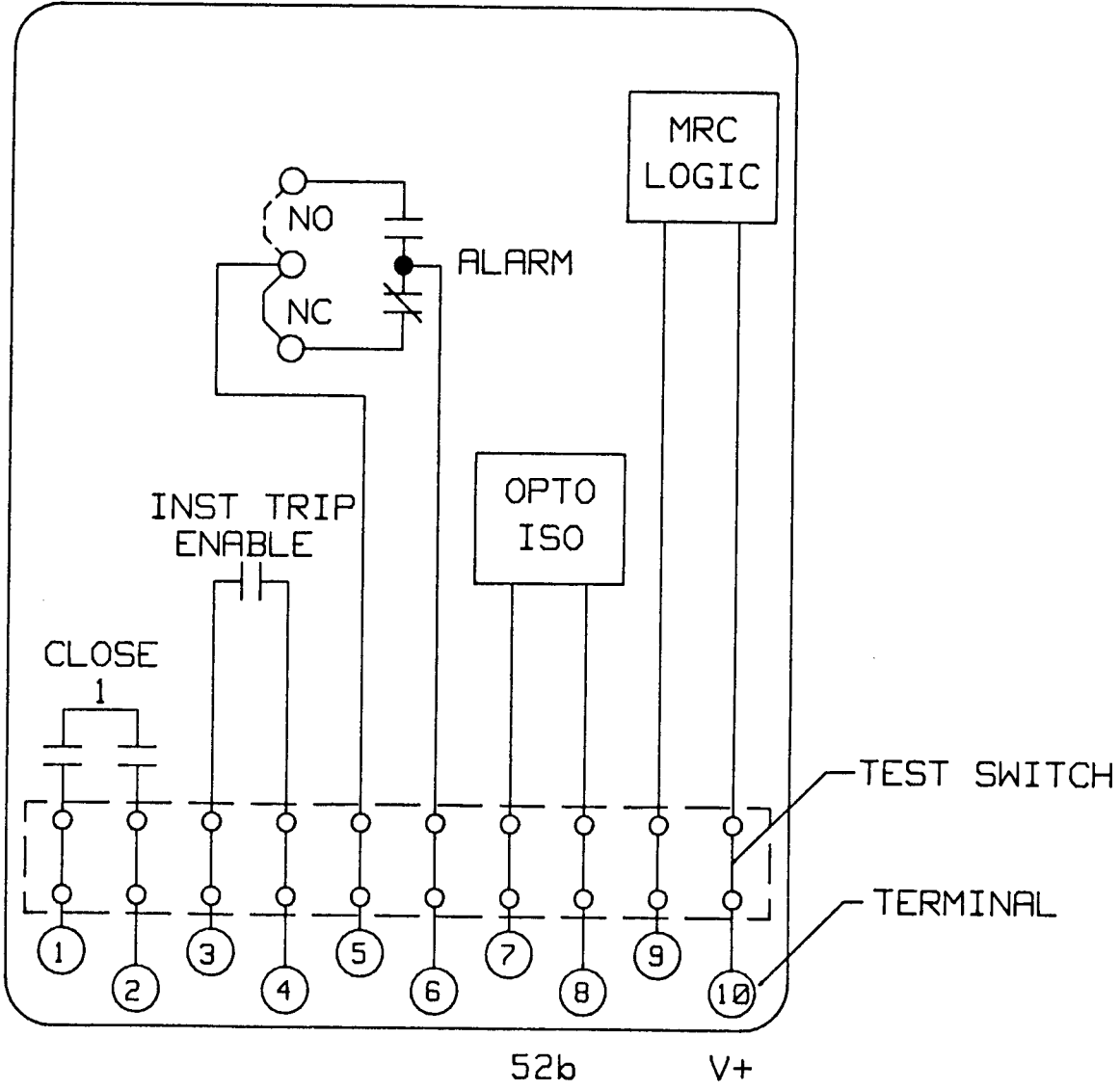
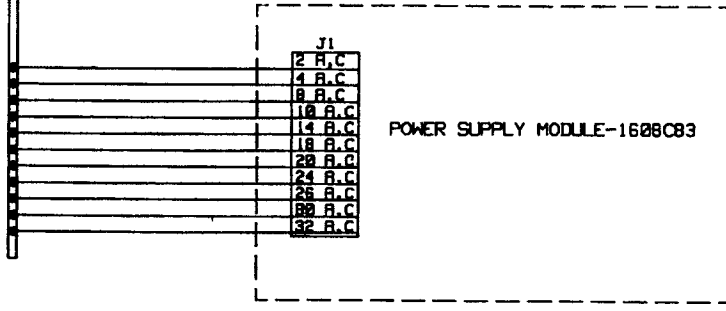
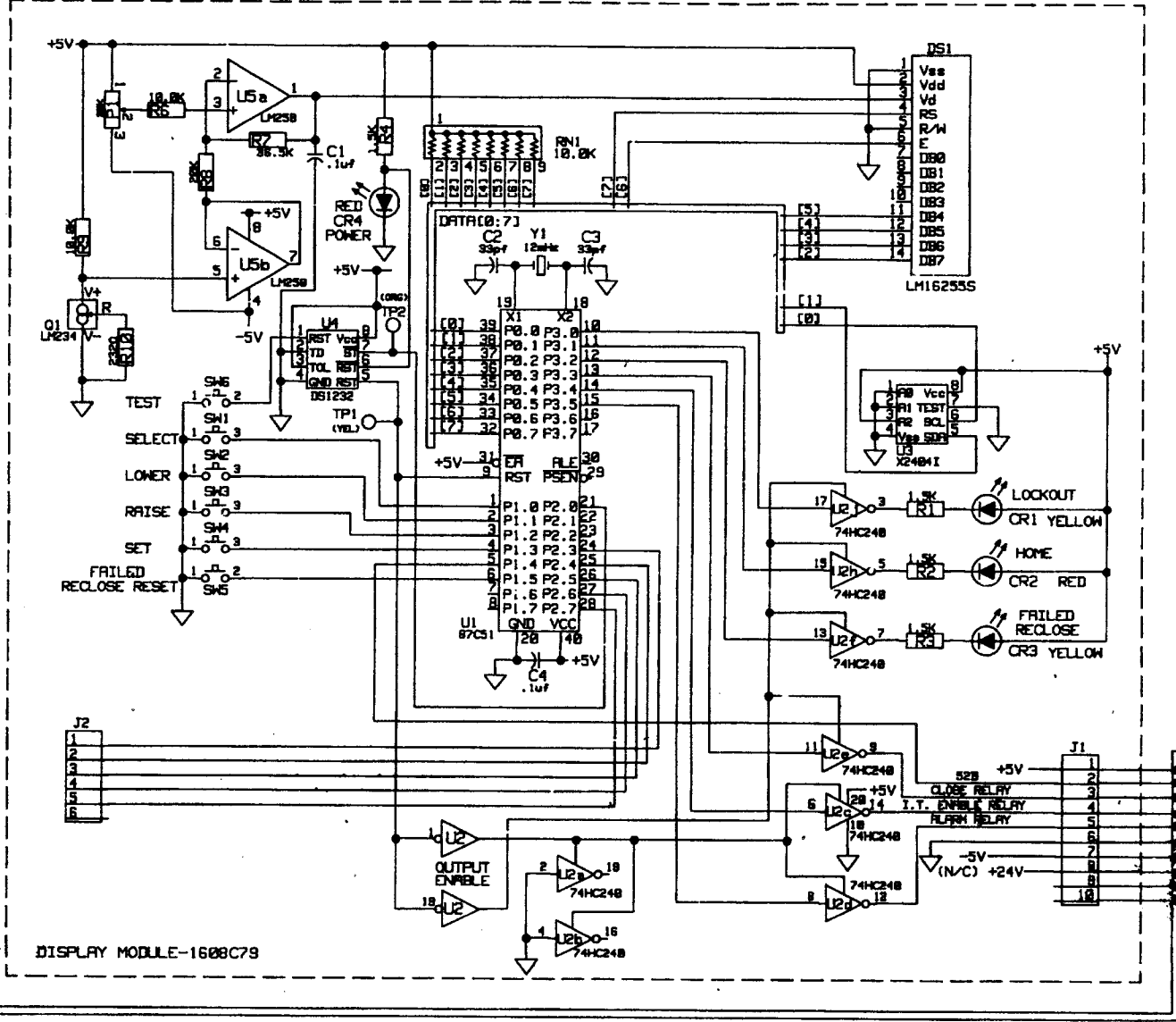
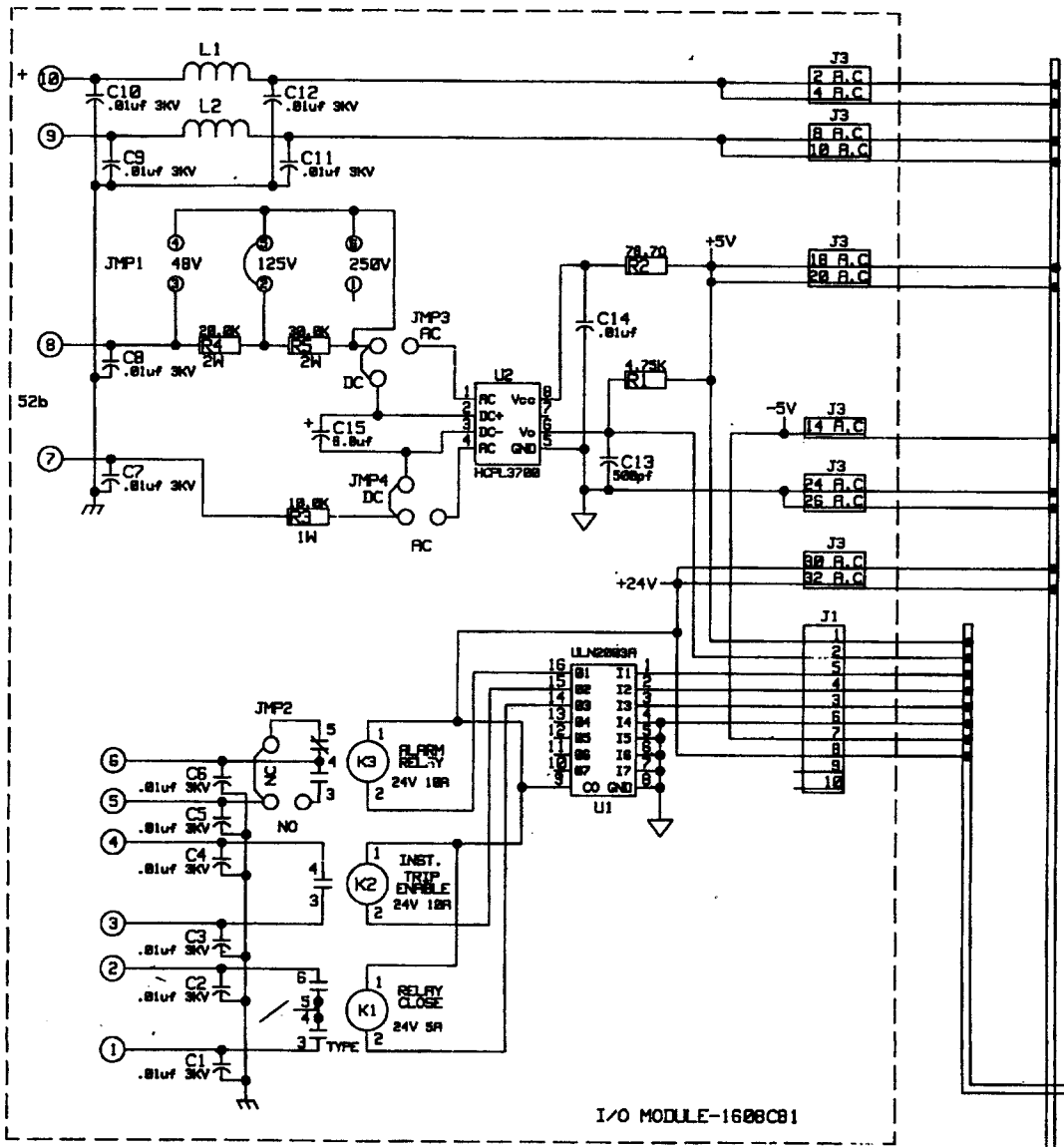


Figure 1. MRC Reclosing Relay



Sub. 2.
9650A27

Figure 2. MRC in FT-21 Case, Simplified Schematic



UNPLUGGING ROUTING CODE	R	P	V	F	20	24	35	36	37	38	39	40	41	42	43	44	45	46	

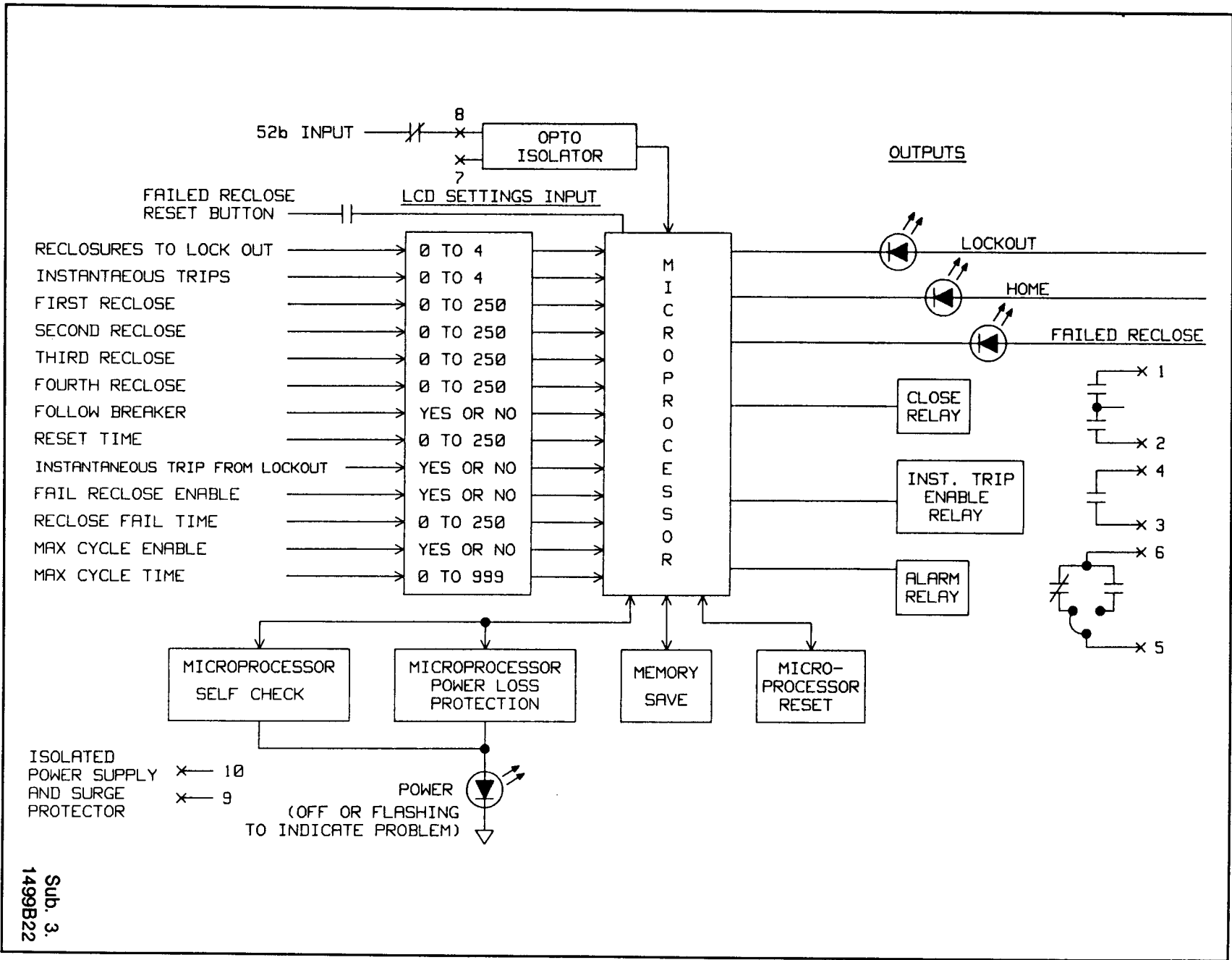
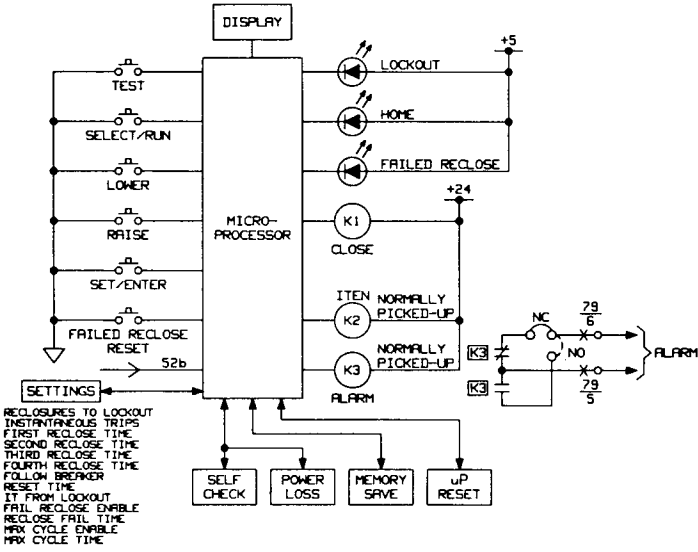
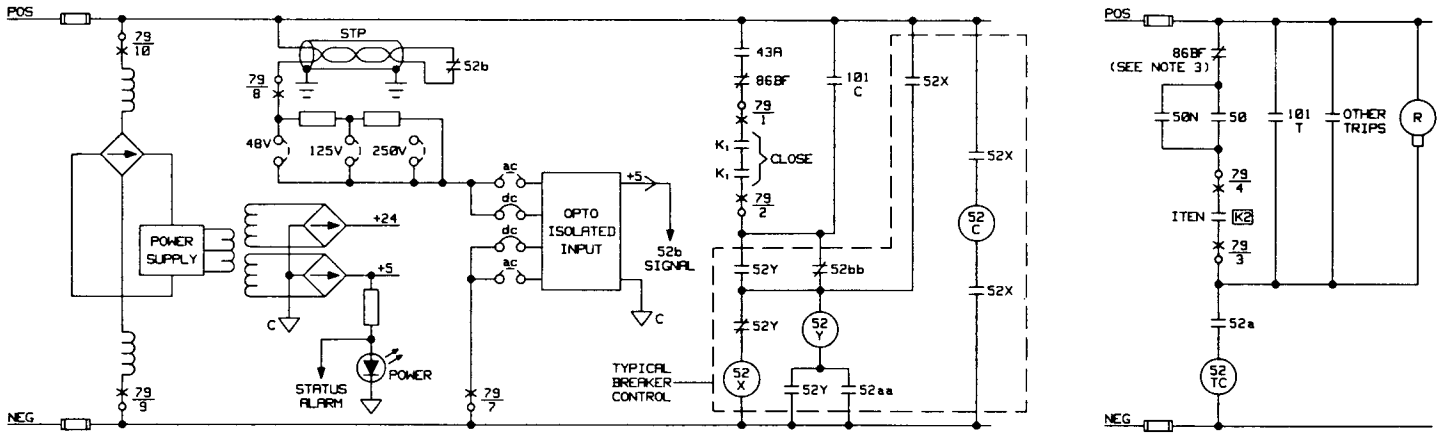


Figure 4. Functional Block Diagram

Sub. 3.
1499B22

Figure 6. External Schematic FT-21 Version



RECLOSE TO LOCKOUT
INSTANTANEOUS TRIPS
FIRST RECLOSE TIME
SECOND RECLOSE TIME
THIRD RECLOSE TIME
FOURTH RECLOSE TIME
FOLLOW BREAKER
RESET TIME
IT FROM LOCKOUT
FAIL RECLOSE ENABLE
RECLOSE FAIL TIME
MAX CYCLE ENABLE
MAX CYCLE TIME

- DEVICE NO. S:**
- 43A - RECLOSER SWITCH (CLOSED IN AUTOMATIC)
 - 52 - CIRCUIT BREAKER
 - 52aa- AUX SW (EARLY CLOSE WHEN BREAKER CLOSSES)
 - 52b - AUX SW (CLOSED WHEN BREAKER OPENS)
 - 52bb- AUX SW (EARLY CLOSE WHEN BREAKER OPENS)
 - 52C - CLOSE COIL
 - 52T - TRIP COIL
 - 52X - CLOSE AUX
 - 52Y - ANTI PUMP
 - 79 - RECLOSING RELAY, TYPE MRC
 - ITEN- INSTANTANEOUS TRIP ENABLE- $\overline{K2}$ -NORMALLY PICKED-UP RELAY
 - K1 - CLOSE RELAY
 - K3 - ALARM RELAY- $\overline{K3}$ -NORMALLY PICKED-UP RELAY
 - 86BF- BREAKER FAILURE LOCKOUT RELAY CONTACT
 - 101 - BREAKER CONTROL SWITCH
 - 101C- CLOSE CONTACT
 - 101T- TRIP CONTACT

- NOTES:**
1. MRC IS SUITABLE FOR OPERATION WITH ac OR dc POWER INPUT. SEE INSTRUCTION LEAFLET.
 2. ALL CONTACTS ARE SHOWN IN STATE WITH RELAY DEENERGIZED. K2 AND K3 COILS ARE ENERGIZED IN "HOME".
 3. 86BF CAN BE USED TO AVOID POSSIBLE TRIP COIL DAMAGE ONLY WHERE THERE IS A SEPARATE 86BF FOR THIS BREAKER.

Sub. 1.
1609C87

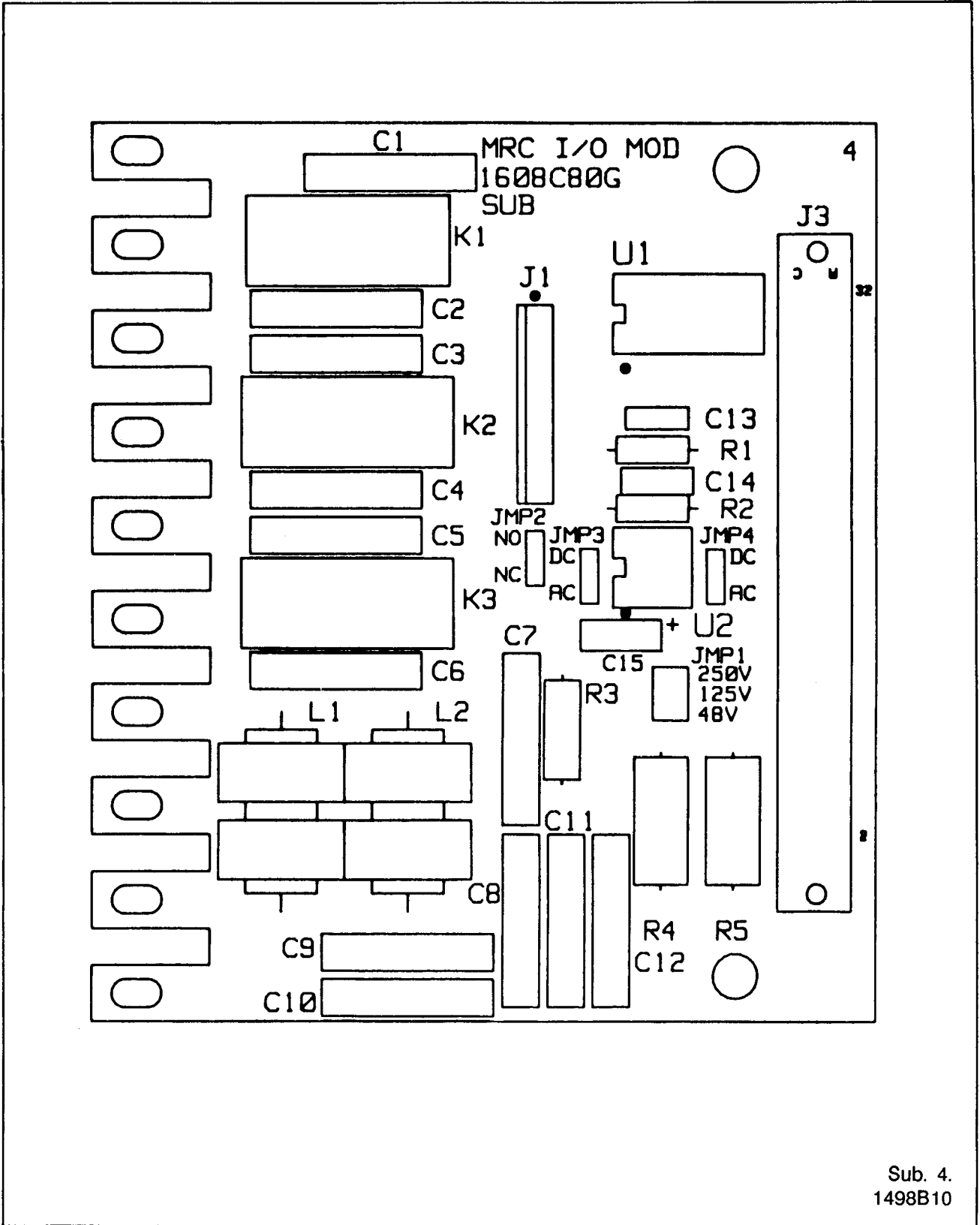
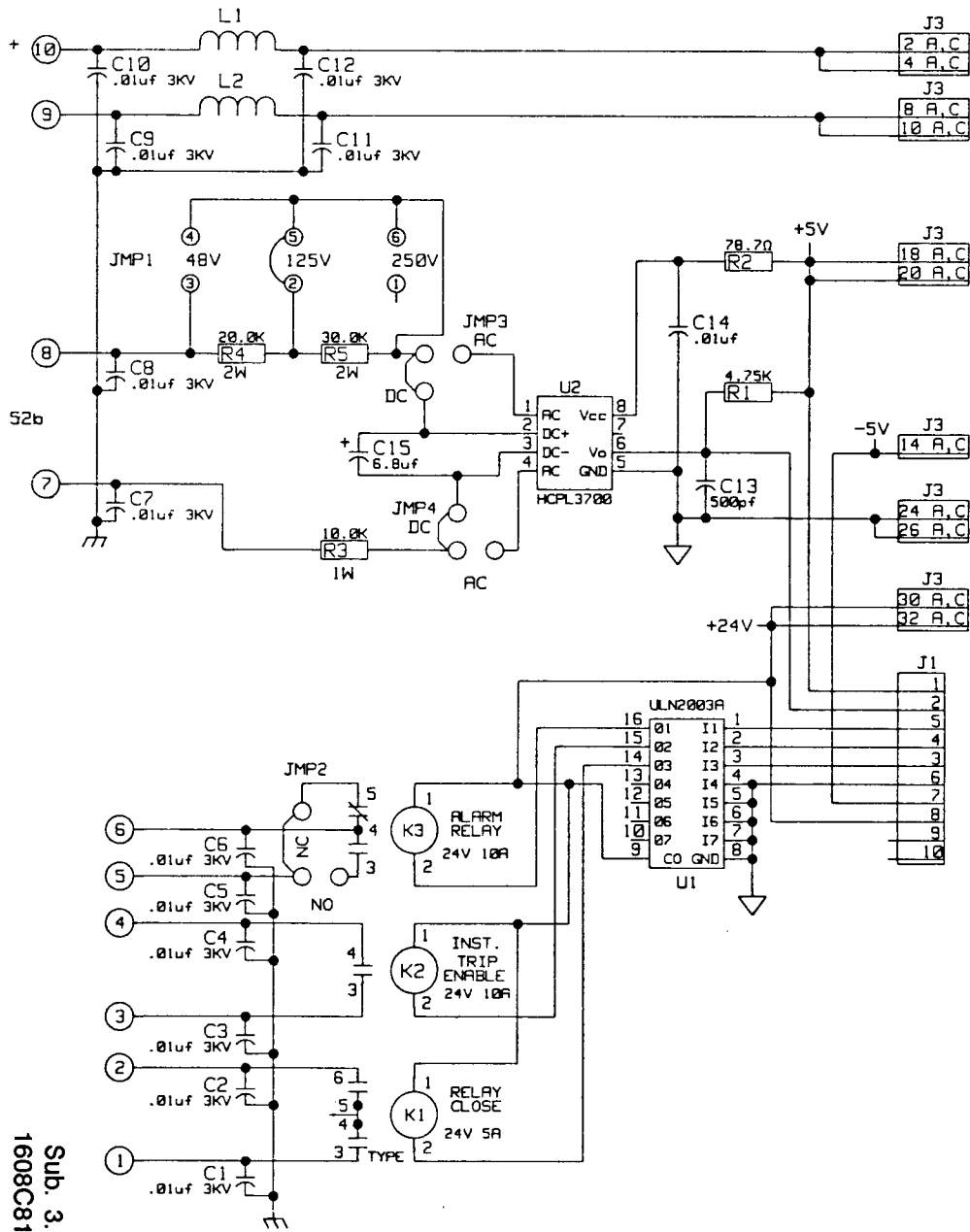


Figure 7. Component Location I/O Module

Figure 8. Internal Schematic I/O Module



CAPACITOR		
C01	.01uf 3KV	3536A32H02
C02	.01uf 3KV	3536A32H02
C03	.01uf 3KV	3536A32H02
C04	.01uf 3KV	3536A32H02
C05	.01uf 3KV	3536A32H02
C06	.01uf 3KV	3536A32H02
C07	.01uf 3KV	3536A32H02
C08	.01uf 3KV	3536A32H02
C09	.01uf 3KV	3536A32H02
C10	.01uf 3KV	3536A32H02
C11	.01uf 3KV	3536A32H02
C12	.01uf 3KV	3536A32H02
C13	500pf 500V	184A663H05
C14	.01uf 100V	184A663H01
C15	6.8uf 35V	184A661H10

RELAY		
K1	2a 24V 5A	9645A10H07
K2	1c 24V 10A	9645A10H02
K3	1c 24V 10A	9645A10H02

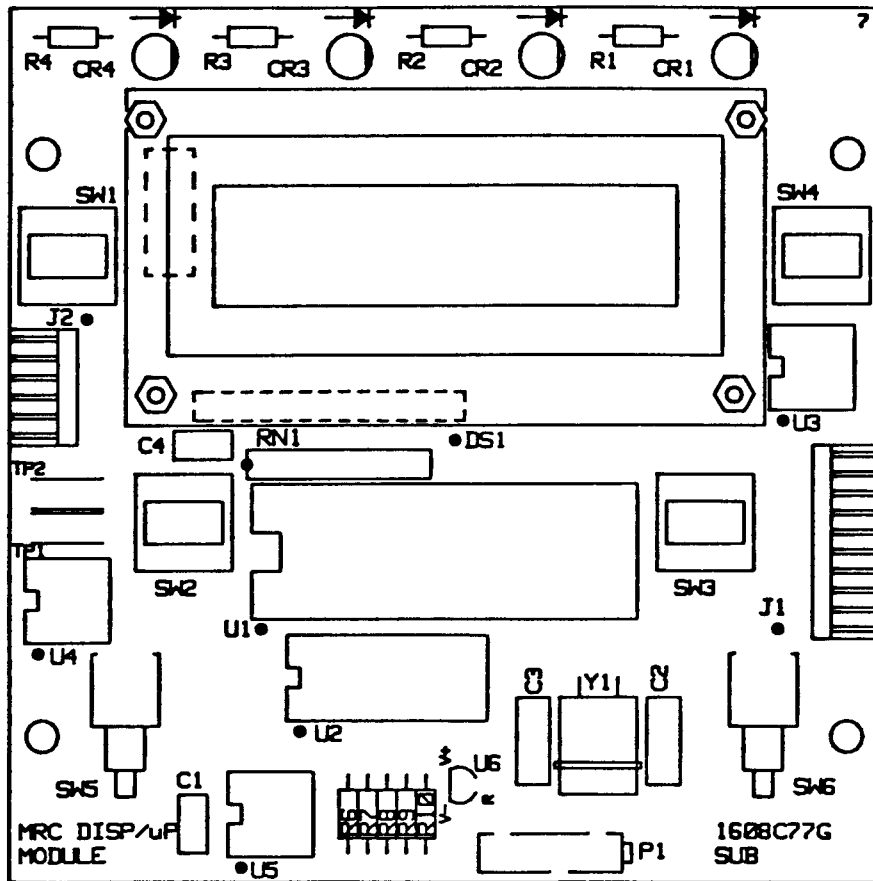
INDUCTOR		
L1	2.0 mH	3500A27H01
L2	2.0 mH	3500A27H01

RESISTOR		
R1	4.75K .25W	848A820H14
R2	78.7Ω .25W	848A818H41
R3	10.0K 1W	187A643H51
R4	20.0K 2W	185A207H58
R5	30.0K 2W	185A207H62

INT CKT		
U1	ULN2003A	3533A01H01
U2	HCPL3700	775B621H02

REF DWG:
 A-MODULE 1608C80
 COMP LOC 1498B10 (PG.7)

Sub. 3.
 1608C81



Sub. 7.
1498B08

Figure 9. Component Location Display/Processor Module

GROUP 1

C1	.1uF 100V	762F680H14
C2	33pF 500V	763R209H13
C3	33pF 500V	763R209H13
C4	.1uF 100V	762F680H14
CR1	YELLOW	9640A49H02
CR2	RED	9640A49H01
CR3	YELLOW	9640A49H02
CR4	RED	9640A49H01
DS1	LM16255S	9649A48H01
J1	10 PIN SQL ROW	9646R97H03
J2	6 PIN SQL ROW	9646R97H05
F1	20.0K	880R626H01
R1	1.5K .25W 1%	3535A38H18
R2	1.5K .25W 1%	3535A38H18
R3	1.5K .25W 1%	3535A38H18
R4	1.5K .25W 1%	3535A38H18
R6	10.0K .25W 1%	3535A37H01
R7	36.5K .25W 1%	3535A37H55
R8	20.0K .25W 1%	3535A37H00
R9	10.0K .25W 1%	3535A37H01
R10	232-0HM .25W 1%	3535A39H06
RN1	10.0K 9 PIN SIP	3533R81H04
SH1	MOMENTARY W/CAP	9646R57H01
SH2	MOMENTARY W/CAP	9645A08H01
SH3	MOMENTARY W/CAP	9645A08H01
SH4	MOMENTARY W/CAP	9645A08H01
SH5	MOMENTARY	9646R57H01
SH6	MOMENTARY	9646R57H01
UI	87CS1	1499B36G01
U2	MC74HC240N	9650R78H01
U3	X24041	1499B35G01
U4	DS1232	9649R50H01
U5	LM259N	9640R97H01
Y1	12 MHz	879R920H08
U6	LM234	9649R52H01
TP1	YELLOW (RESET)	3532R53H07
TP2	ORANGE (STROBE)	3532R53H06

REF DWGS:
 A-MODULE 1608C77G01
 COMP LOC 1498B08 (PG. 8)

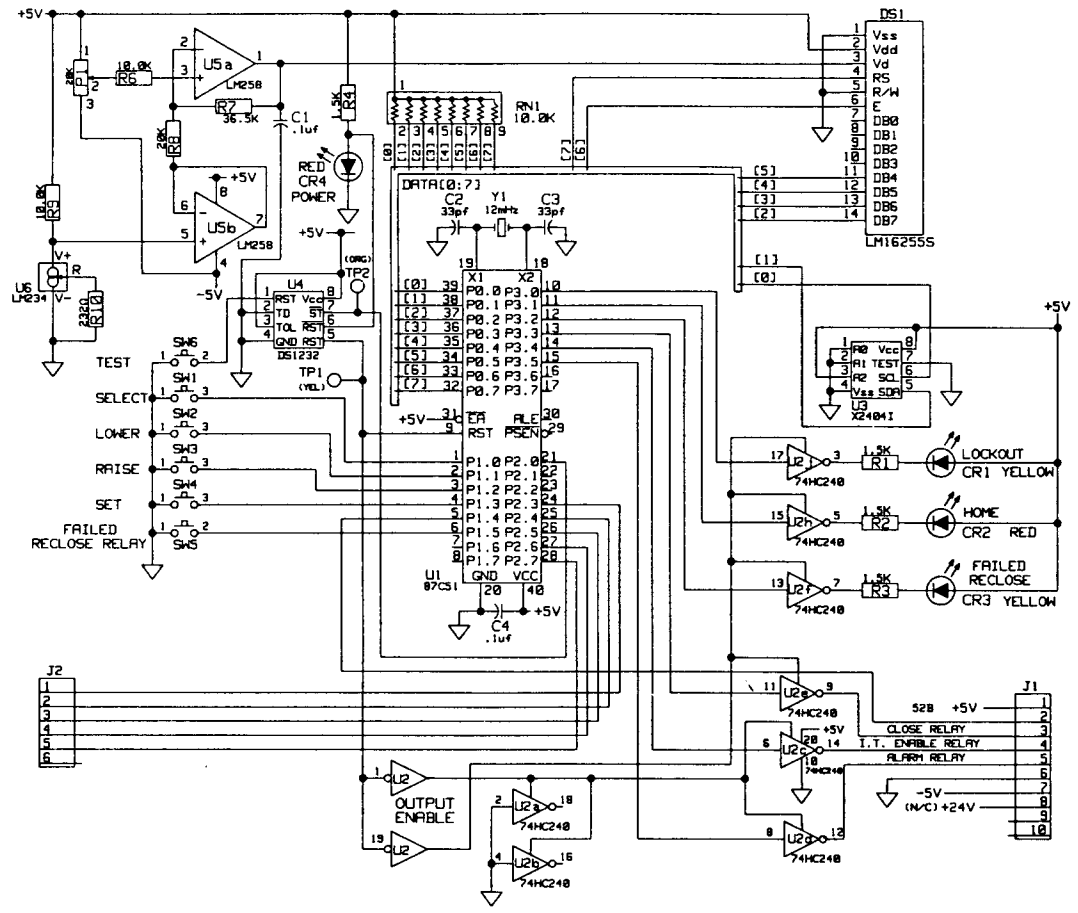
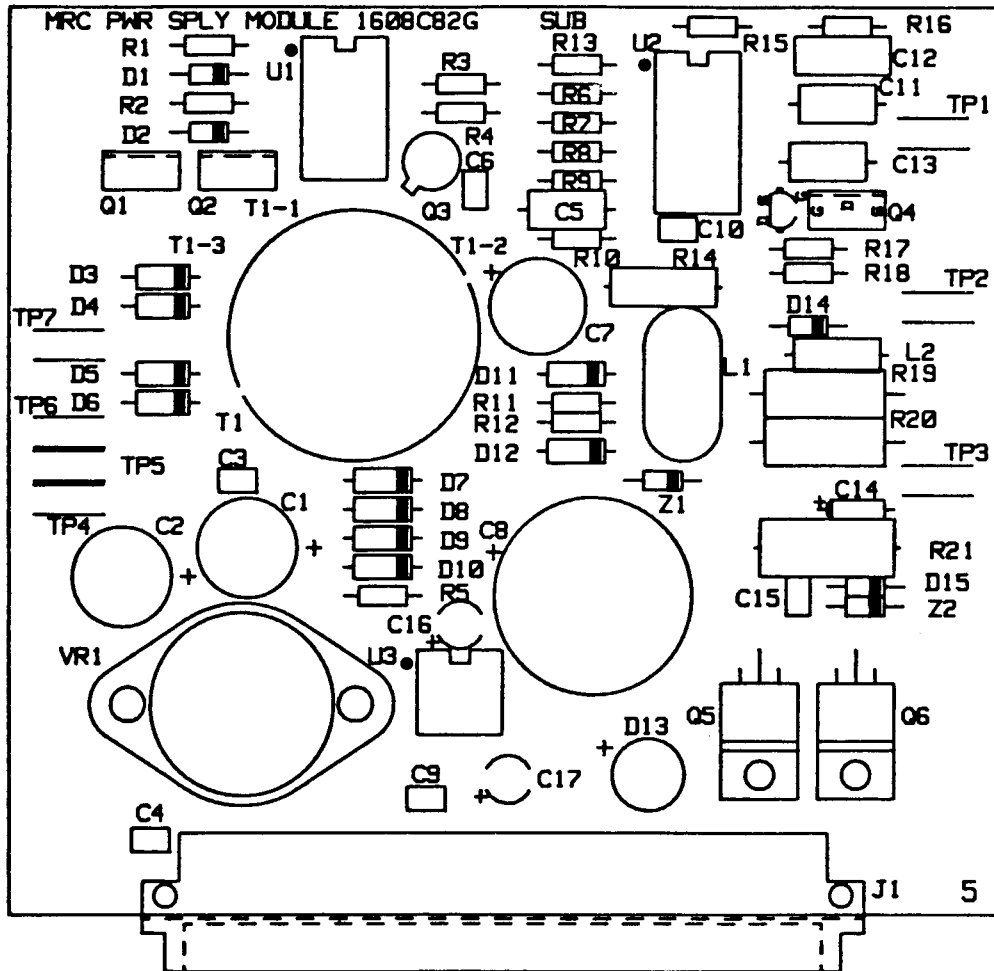


Figure 10. Internal Schematic Display/Processor Module

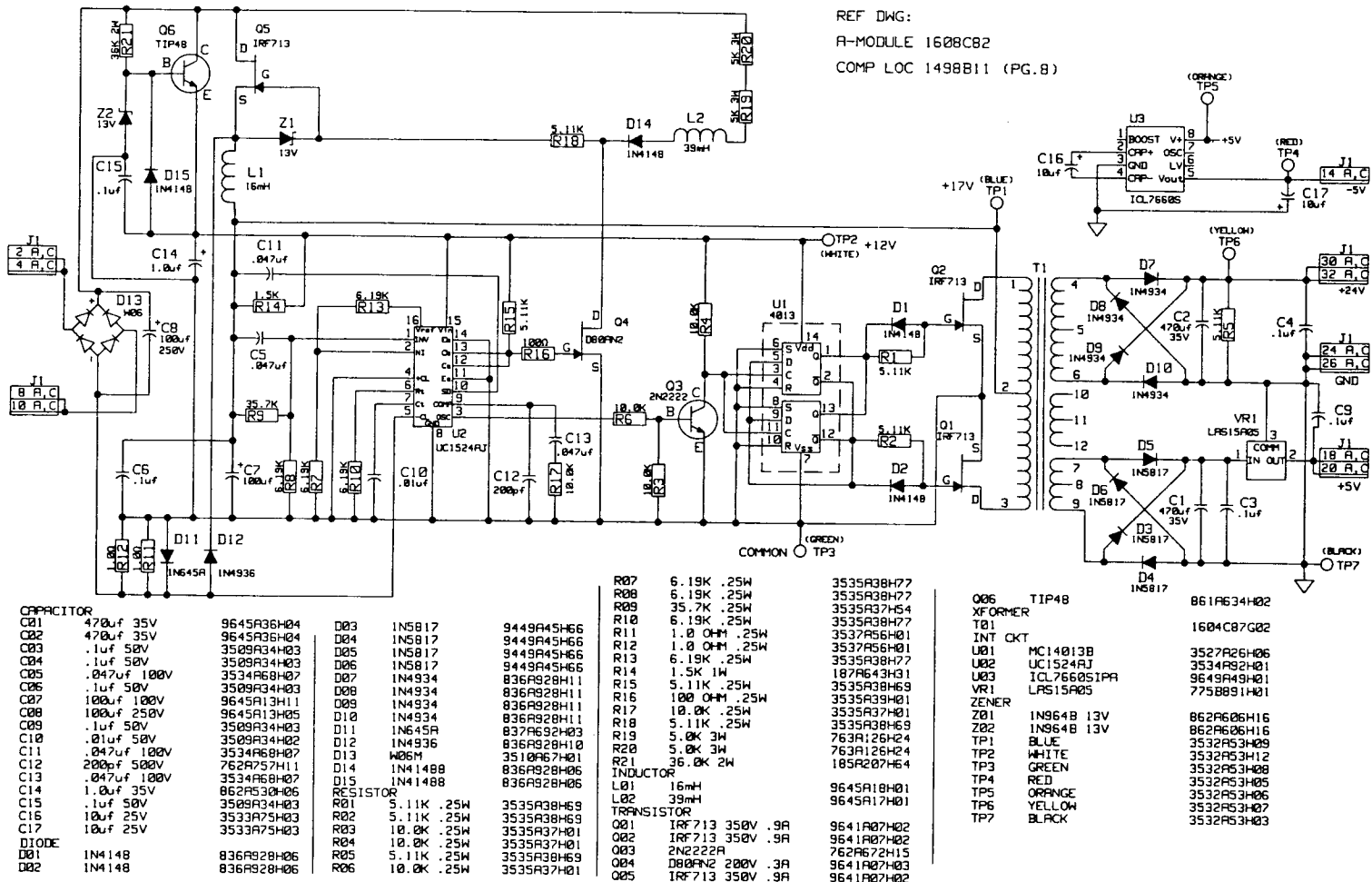
Sub. 5.
 1608C79
 Sheet 1 of 2



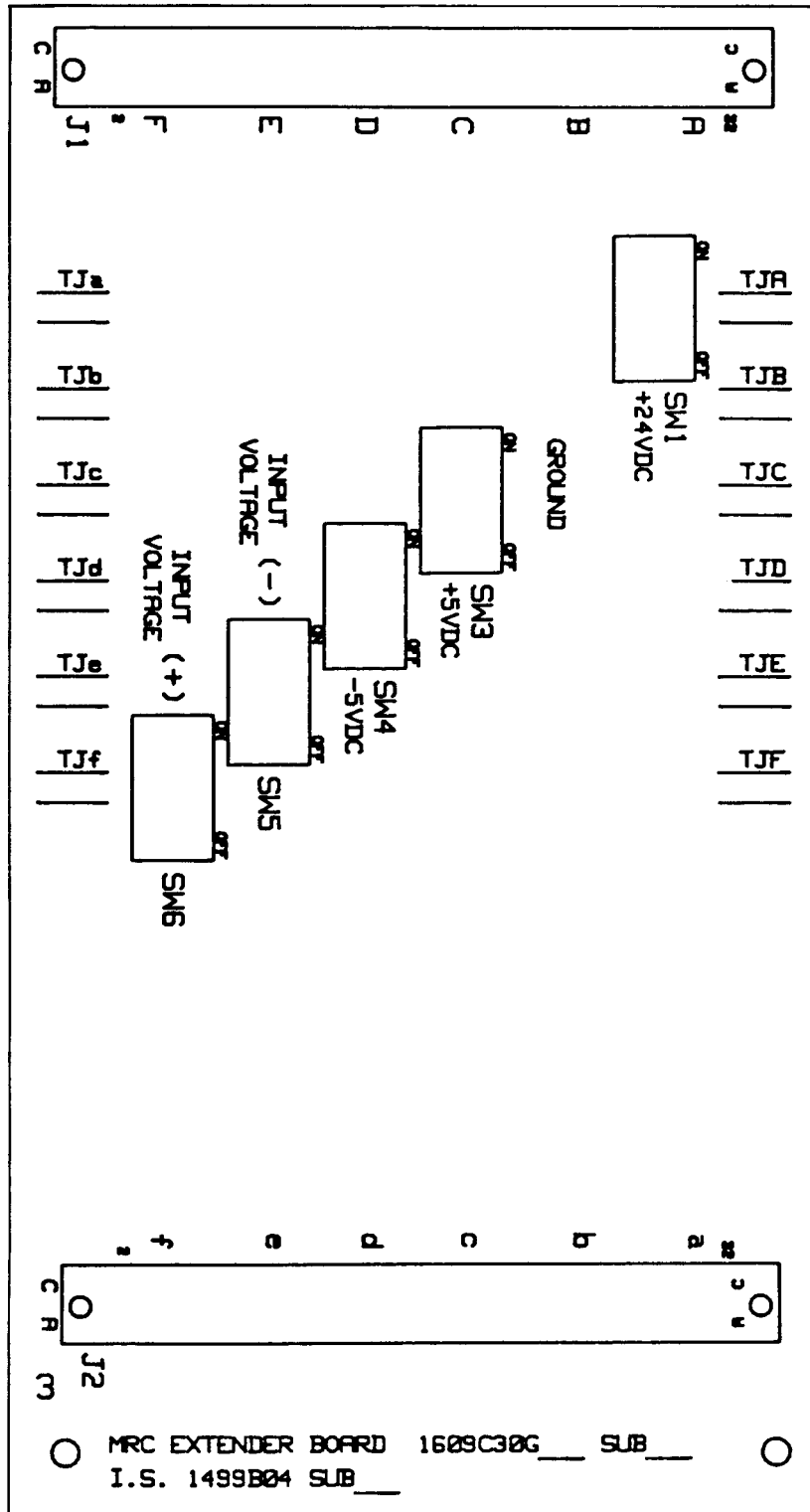
Sub. 5.
1498B11

Figure 11. Component Location Power Supply Module

Figure 12. Internal Schematic Power Supply



Sub. 2.
1608C83

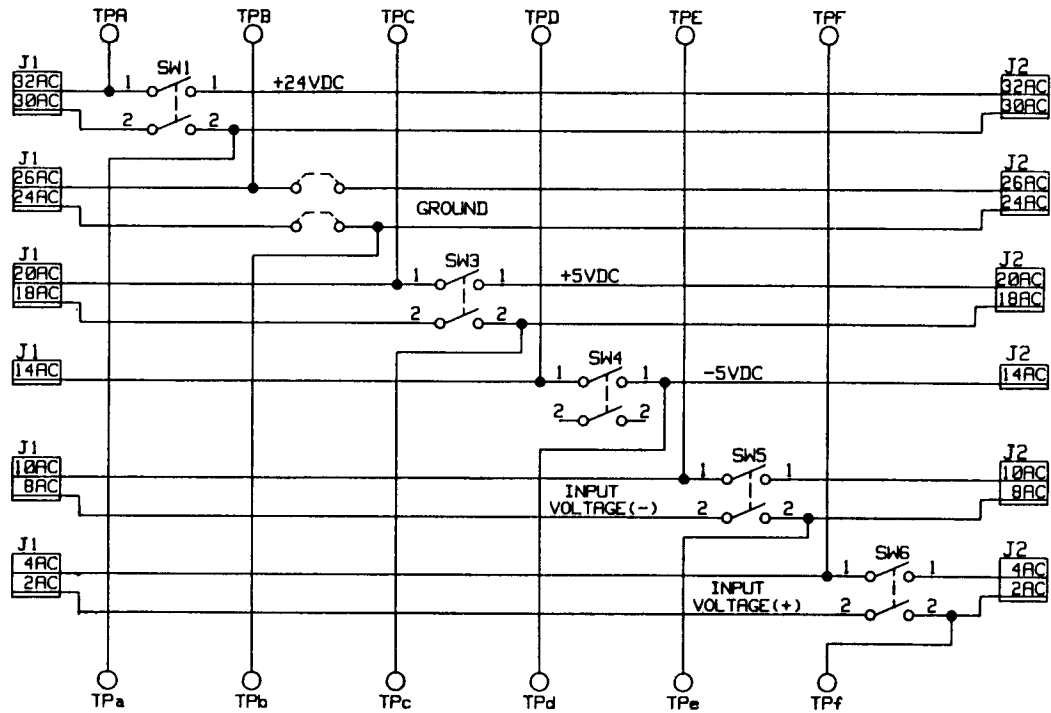


Sub. 3.
1499B03

Figure 13. Component Location Extender Board

Figure 14. Internal Schematic for the Extender Board

- SWITCH
- | | |
|----|------------|
| S1 | 9649A95H01 |
| S3 | 9649A95H01 |
| S4 | 9649A95H01 |
| S5 | 9649A95H01 |
| S6 | 9649A95H01 |
- TIP JACK
- | | | |
|----------------------|--------|------------|
| TJA, TJ _a | YELLOW | 3532A53H07 |
| TJB, TJ _b | BLACK | 3532A53H03 |
| TJC, TJ _c | ORANGE | 3532A53H06 |
| TJD, TJ _d | RED | 3532A53H05 |
| TJE, TJ _e | BROWN | 3532A53H04 |
| TJF, TJ _f | PURPLE | 3532A53H10 |



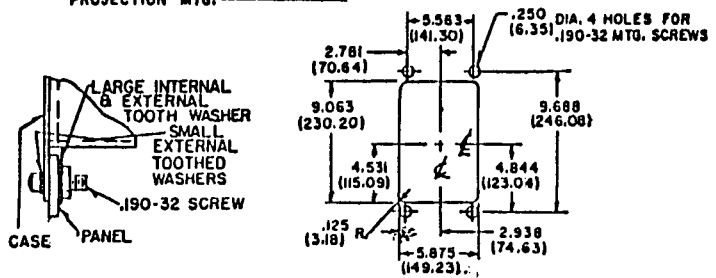
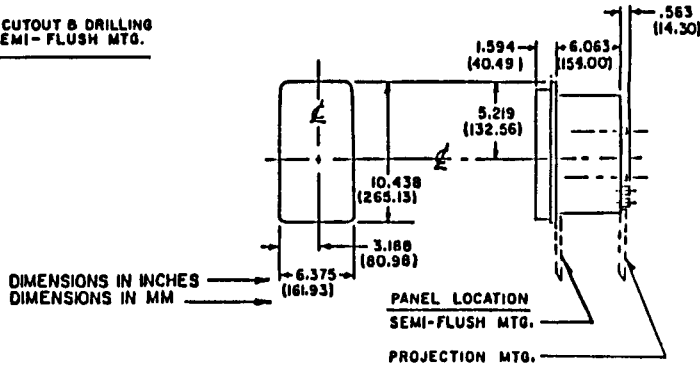
REF DWG: A-MODULE 1609C30
 COMP LOCA (PG.7) 1499B03

REF:
 PC BOARD-----1499B03

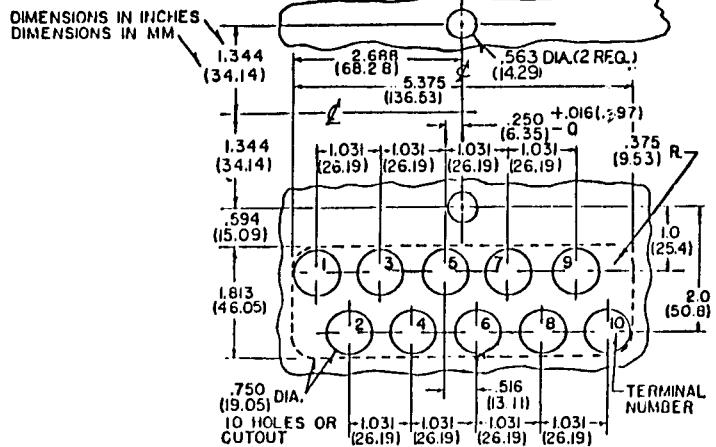
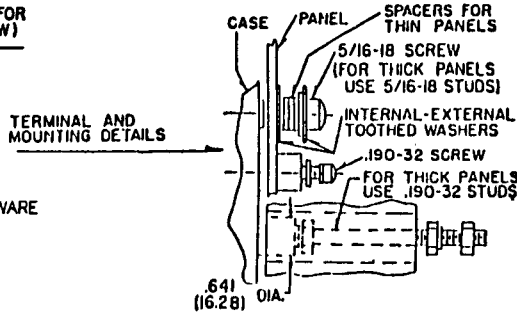
Sub. 1.
 1499B04

OUTLINE AND DRILLING FOR RELAY CASE TYPE FT-21

PANEL CUTOUT & DRILLING FOR SEMI-FLUSH MTO.



PANEL DRILLING OR CUTOUT FOR PROJECTION MTO.(FRONT VIEW)



Sub. 15.
57D7901

Figure 15. MRC Mounting in FT-21 Case

ABB POWER T&D COMPANY INC.
Protective Relay Division
7036 Snowdrift Rd., Allentown, PA 18106 USA