Installation and Operation Manual

MODEL X110 CONTROLLER MODULE

SERIAL INPUT ANNUNCIATOR NETWORK

MANUAL X110-3000
REVISION 1.7
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RONAN

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WARNING

Before service to an X110 Controller is attempted, the following procedure **MUST** be followed:

- The X110 Controller to be repaired **must** be isolated from the other X110s. This is accomplished by removing all communication cables J1, J2 and J3 from the X110 to be repaired. Proceed to next step.

- Next, the power **must** be removed from the X110 board to be repaired. Typically, the X110 power is supplied through circuit breakers to the X110 power connector, J4. In this case, the repair can proceed by removing the X110 board from the mounting plate.

In situations where the power is supplied to the X110 through the lamp cabinet, connectors J4, J5 and J6 must be removed to power down the X110. The repair can proceed by removing the X110 board from the mounting plate.

When service to the X110 controller is complete, reverse the process:

- First, reconnect the power connector J4 (J5 and J6 if applicable) to the X110 which was serviced. If a breaker is present, power up the X110.

- Next, reconnect the communication cables J1, J2 and J3.

If this procedure is not followed, damage could result to the entire X110 network!

SECTION 1 - INTRODUCTION

1.0 GENERAL

The Ronan Model X110 Annunciator is designed to accept and screen serial ASCII messages pertaining to alarm and normal process conditions and to initiate appropriate audio-visual responses. The X110 provides input communication ports for accepting host transmission in RS232-C, RS422, RS485 or Current Loop. Data rates are selective ranging from 1200 baud through 19,200 baud.

A single X110 is capable of controlling up to 48 display windows and recognizing 9,999 input point numbers. Each display window can be individually assigned to any of the ISA sequences (or derivatives) and is capable of responding to scores of input points. A network of X110s can easily be interconnected from a single host input.

Conditions are reported to the X110 within a serial ASCII character string. The character string contains the "POINT" of origin, represented as a decimal number, and up to three pre-defined characters that distinguish the condition as favorable (i.e., NORMAL) or unfavorable (i.e., ALARM). Optionally, the X110 conditions are reported to the X110 by an Allen Bradley PLC-5 network through an RS232 converter which sends a bit mapped status periodically to the X110 (see Section 9 for further details). The X110 operates illuminated display "WINDOWS" and audible devices based on a comparison between this reported data and previously defined set-up information furnished by the user.

1.1 Overview

The X110 operates in one of two modes: Configuration or Run Mode. These operating modes can be selected by a dipswitch located on the X110 or, at the user's option, through the serial channel by means of specially defined "ESC" character sequences.

1.1.1 Configuration Mode

Placing the X110 into the Configuration Mode allows the user, by means of any standard terminal, to supply all of the operational parameters needed by the X110 once it becomes active in the Run Mode. A simple, menu-driven, dialogue initiated from the X110 guides the user in assigning the input point(s) and the sequence style for every display window. The "Main Menu" presented on the terminal's display screen is shown in Figure 1-1.

Selecting from the Main Menu produces a theme menu directed specifically towards the selection that the user has just made. As various parameter entries are obtained from the user, they are stored by the X110 in its internal E^2PROM.

Section 4 provides Menu and Configuration information in a detailed, tutorial format.

```
RONAN X110 ANNUNCIATOR
Configuration Mode active
Select Operation then enter Carriage Return:

Version:   COMRD04    Date:  May 16, 1991

H -X110 Host Computer (X120, X500, X510, X1000)
U -Unit Number Assignment
C -Communication Parameters
P -Pattern Recognition Parameters
W -Set Window Assignments
F -First Out Group Assignments
L -List all Window Assignments
V -View Individual Window Assignments
M -Audibles and Options
D -Diagnostics
Q -Exits X110 Configuration Mode
```

Figure 1-1 Main Configuration Menu

Display windows are created by giving them a sequence style and point numbers with which they should react. During configuration, the windows are described by number from left to right as shown in Figure 1-2. 48 windows are available with a single X110 controller. Decimal point numbers from 1 to 9999 are acceptable as inputs to a window (a given point number cannot be repeated within a particular X110).

If the X110 is used with a Ronan X500, a mux/channel format may be chosen in place of the standard decimal point numbers. In this format, acceptable values are:

From 00 through 31 for a mux
From 00 through 127 for a channel

If the X110 is used with a Ronan X120 Multiplexer, a point number format is chosen. In this case, the acceptable values are XXYY.

XX=X120 Mux number (01-32)
YY=X120 Channel number (01-48)

Examples:
01 22, 23 47, 32 48 and so on.

Note: if the first digit of the point number is zero you do not have to enter that zero digit. Therefore, 0245 is the same as 245.

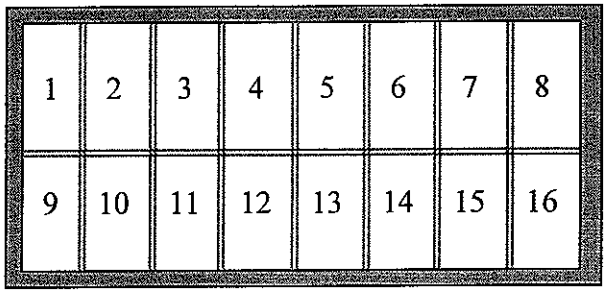


Figure 1-2 Display Window Numbering
(Up to a total of 48 windows)

The status of any reported condition precedes the point number. Status is a uniquely recognizable "pattern" consisting of specific characters or symbols declared by the user. For example, the patterns of "AC" and "NC" might be chosen to express alarm and normal conditions in which case they would be entered into the X110 during the "P"attern recognition portion of a configuration session.

1.1.2 Run Mode

Once configured, an X110 can be set to its usual Run Mode of operation. While in Run Mode, the arriving ASCII messages are constantly screened for any patterns that compare with those assigned to alarm or normal conditions. If such a comparison occurs, the X110 scrutinizes the remainder of the message for a point number that matches any of those that have been assigned to it. A match results in appropriate action to the corresponding display window and possibly to attached audible devices.

Assume for a moment that Window 6 is configured to react to Point Number 8562. A simple message such as "AC 8562" would notify the X110 that Window 6 should begin its ALARM sequence. A message of "AC 12:15:57 8562 MOTOR NO. 7 EXCESSIVE BEARING TEMPERATURE" would have the same result because the X110 skips over the time-of-day and legend information in a message.

The ASCII message is considered complete when a Carriage Return (0D Hex) is received by the X110.

It is also possible to have the X110s recognize a change in field contact closures as alarm input or normal input conditions. During the configuration session, the X110 learns the normal state of the field contacts (closed or open) and reacts accordingly while in Run Mode to a "C" for closed or "O" for open. This scheme is used in conjunction with Ronan's X120 Multiplexer.

Optionally, the X110 can recognize bitmap patterns where every bit represents the state of input in a system. When a bit, associated with a particular X110 window, changes state the X110 will react according to the sequence programmed for that window. The system that is used is an Allen Bradley PLC-5 Data Highway/Data Highway Plus network that communicates to the X110 through an RS232 Converter (see Section 9 for further details).

SECTION 2 - SPECIFICATIONS

2.0 Power

Logic Input Supply Voltage:	+24VDC ±20%
Logic Supply Current:	500mA maximum
Input Supply Voltage:	Lamps & Relays require +24VDC ±20%

2.1 Environment

Operating Temperature:	0° to 60°C (32° to 140°F)
Storage Temperature:	-40° to 85°C (-40° to 184°F)

2.2 Outputs

Display Capacity:	Up to 48 windows individually assigned to any of 9,999 input points (up to 240 designations per X110).
Available Lamp Output Current:	Each lamp output is capable of sinking 500 mA and will sustain 50V in the OFF state. Typical X110 operation with two parallel 2-watt incandescent bulbs for a given window will sink approximately 166 mA at 24VDC.
Relay Outputs:	Three individual DPDT relays rated for 2 amps at 28VDC and 0.5 amps at 120VAC. One relay is for alarm horn control, one is for ringback horn control and the third is a normally energized run relay under control of the X110's Watchdog Timer.

2.3 Inputs

Pushbuttons:	Pushbuttons are normally open. When "made", a DC low logic level (logic ground) is connected through the contacts and a resistive load to +5VDC using approximately 0.5 mA.

2.4 Communications

Electrical Interfaces:	RS232C, RS422, RS485 and Current Loop are available for interfacing to a Host device. X110s are interconnected in accordance with the RS485 standard. Up to 32 X110s may be interconnected in a single group. Optional RS485 repeater circuits permit expansion to 256 units.
Physical Channels:	RS232C or Current Loop connection is through 24AWG (minimum) shielded cable to a 25 pin, female, D-type socket. RS422 or RS485 connection is through 24AWG (minimum) twisted pair, 100-120 ohm (Zo), channels are wired for full duplex operation. X110s appear as DCE (Data Communication Equipment).

Transmission Format:	Asynchronous; 1 start bit; 7 or 8 data bits; odd, even or no parity; 1 or 2 stop bits. Optional: CRC or BCC check character.
Transmission Baud Rates:	1200, 2400, 4800, 9600 and 19.2K baud are selective.

2.5 *Operational Attributes*

Point Recognition:	The X110 recognizes point numbers from 1 to 9,999. It may also be configured to recognize points in a Mux/Channel format: the Mux value range is from 00 to 31; the channel value range is from 000 to 127. **Note: Mux/Channel format is used only if the host is a Ronan X500 System.**
Point Status:	The status of the point (Alarm/Normal) is determined from a selective pair of one, two or three character patterns. One pattern is for "alarm" and the other is for "normal". The actual patter is user defined.
Multiple Point Inputs:	Reflash capability up to 240 inputs into 48 windows.
Alarm Sequences:	ISA Sequences A, A-4, A-5-6, F1A, F2A, F3A, M, F1M, F2M, F3M, R, F1R, F2R, and F3R. Any sequence may be assigned to any window.
Additional Alarm Sequences:	Ronan sequences AAWSM, APRIME, RDSH, RDSMOD1, RMOD1 are also available. Special alarm sequences may be generated (consult factory).
Audible:	Single or dual horn with selective prioritization. Silence can be manual or automatic per ISA-7, 9.
Pushbuttons:	The available pushbuttons are ACKNOWLEDGE, SILENCE, RESET and TEST. These may be independent or interlocked per ISA-1, 2,3.
Data Retention:	The X110's E^2PROM will retain data for a minimum of 10 years without rewriting.

SECTION 3 - INSTALLATION

3.0 Unpacking

Inspect the packaging for evidence of damage during transit. Remove the X110 assemblies (the Logic PCB, the Terminal PCB, the Lamp Cabinet Assembly and cables) and confirm that there is no visible damage. If there is any damage, immediately notify both the carrier's agent and the local Ronan representative.

Compare the received items to the original purchase order and the packing list. If there are differences or missing items, contact your local Ronan representative.

3.1 Preparation

Consult Section 3.4 for the various jumper selective functions and ensure that the factory-installed jumpers reside in the proper place for your application. See Section 3.2 for a description of the external wiring on the plug, P4. Dip Switch, SW1 should be set according to your particular site requirements as shown in Figure 3-9.

3.2 External Wiring

The 24 terminal plug/socket combination, P4/J4, provides the inputs for lamp power, logic power, pushbutton inputs and relay outputs. Figure 3-1 identifies the terminals of J4 (see also drawing X110D16).

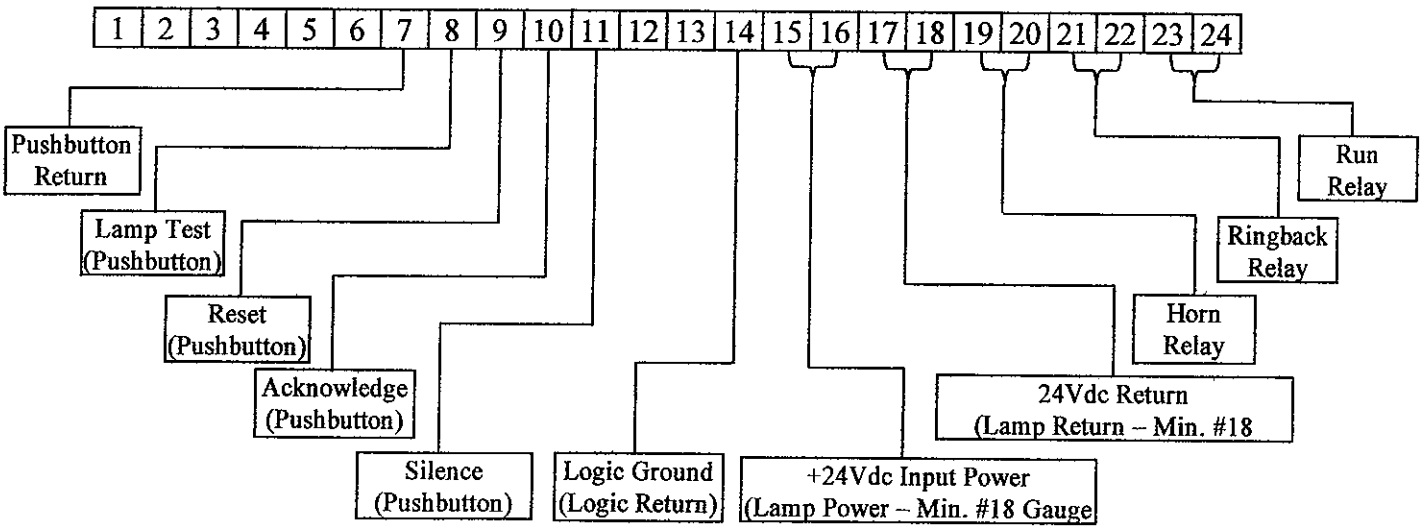


Figure 3-1 P4/J4 Terminals

P4/J4, Pin 1: No longer used.

P4/J4, Pin 2: Reserved for future use.

P4/J4, Pin 3: Reserved for future use.

P4/J4, Pin 4: An input pin that can be connected to an EXTERNAL RESET. The external reset fully clears the X110 in exactly the same manner as a power on. Please note that this is NOT the input pin that is used to accept the pushbutton input for a sequence reset; that is pin 9.

P4/J4, Pin 5: OPTIONAL: This is a special input pin whose purpose is to substitute a "back-up" X110 for a master X110 that has gone out of service. (See also P4/J4, Pin 13).

P4/J4, Pin 7: An output pin that provides signal (logic) ground for external use in wiring various pushbuttons.

P4/J4, Pin 8: The input pin for the LAMP TEST pushbutton.

P4/J4, Pin 9: The input pin for the RESET pushbutton. This is the sequence reset pushbutton.

P4/J4, Pin 10: The input pin for the ACKNOWLEDGE pushbutton.

P4/J4, Pin 11: The input pin for the SILENCE pushbutton.

P4/J4, Pin 13: Open collector output used for special functions only.

P4/J4, Pin 14: Provided as a separate connection for logic ground. Although pin 14 is normally common with the lamp return terminals (P4/J4, pins 17 & 18), it is recommended as a return path for logic ground to the source power supply.

P4/J4, Pin 15: 1 of 2 input pins that supply +24VDC. This voltage powers the lamps and onboard relays. Optionally, it may also be used as the source voltage for conversion to +5VDC logic power.

P4/J4, Pin 16: Another input pin for supplying +24VDC. If the lamp power load exceeds 150 watts (38 windows @ 4 watts each) then both terminals J4-15 & J4-16 must be used.

P4/J4, Pin 17: One of two pins that allow for connection of the 24VDC return.

WARNING: ***When more than one X110 is used in a daisy chain configuration, all X110 units must have a common ground cable between the X110 units. This ground cable must never be removed while the X110 string is powered up. Damage to the entire chain of X110s could result if this precaution is not taken.***

P4/J4, Pin 18: Another return pin for the 24VDC that must be used if the lamp power load exceeds 150 watts.

WARNING: ***When more than one X110 is used in a daisy chain configuration, all X110 units must have a common ground cable between the X110 units. This ground cable must never be removed while the X110 string is powered up. Damage to the entire chain of X110s could result if this precaution is not taken.***

P4/J4, Pin 19/20: Output pins for the Horn Relay.

P4/J4, Pin 21/22: Output pins for the Ringback Relay.

P4/J4, Pin 23/24: Output pins for the Run Relay.

X110 RCO LAMP DRIVER PIN ASSIGNMENTS

J5 (ELCO 8016)		J6 (ELCO 8016)	
PIN	OUTPUT (-24VDC)	PIN	OUTPUT (-24VDC)
J5 - A	1	J6 - A	25
J5 - B	2	J6 - B	26
J5 - C	3	J6 - C	27
J5 - D	4	J6 - D	28
J5 - E	5	J6 - E	29
J5 - F	6	J6 - F	30
J5 - H	7	J6 - H	31
J5 - J	8	J6 - J	32
J5 - K	9	J6 - K	33
J5 - L	10	J6 - L	34
J5 - M		J6 - M	
J5 - N		J6 - N	
J5 - P	11	J6 - P	35
J5 - R	12	J6 - R	36
J5 - S	13	J6 - S	37
J5 - T	14	J6 - T	38
J5 - U	15	J6 - U	39
J5 - V		J6 - V	
J5 - W		J6 - W	
J5 - X		J6 - X	
J5 - Y		J6 - Y	
J5 - Z	16	J6 - Z	40
J5 - AA	17	J6 - AA	41
J5 - BB	18	J6 - BB	42
J5 - CC	19	J6 - CC	43
J5 - DD	20	J6 - DD	44
J5 - EE		J6 - EE	
J5 - FF		J6 - FF	
J5 - HH	21	J6 - HH	45
J5 - JJ	22	J6 - JJ	46
J5 - KK	23	J6 - KK	47
J5 - LL	24	J6 - LL	48
J5 - MM		J6 - MM	
J5 - NN		J6 - NN	
J5 - PP		J6 - PP	
J5 - RR		J6 - RR	
J5 - SS	COMMON (+24VDC)	J6 - SS	COMMON (+24VDC)
J5 - TT	COMMON (+24VDC)	J6 - TT	COMMON (+24VDC)

Figure 3-2 J5 and J6 Lamp Driver Outputs

3.3 Interface Ports

There are three communication ports on the X110 Controller:

- J3 is used solely for "daisy-chaining" to another X110 or to another device in an RS422/485 serial string
- one of the other two sockets, either J1 or J2, serve to make the initial connection with a host device
- The X110s that follow the first X110 use connector J2 as a daisy chain "in" and connector J3 as a daisy chain "out" respectively as shown in Figure 3-3.

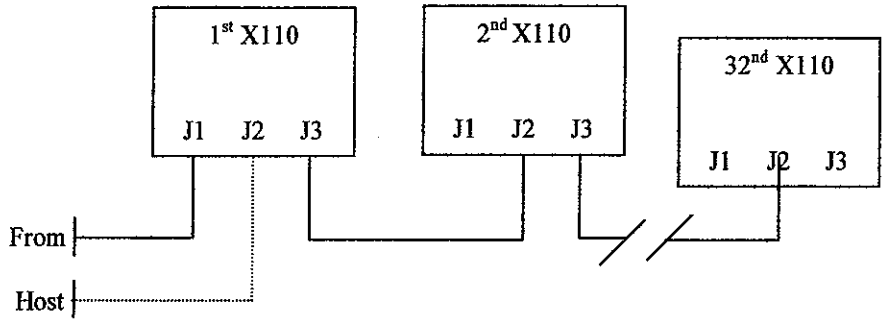


Figure 3-3 X110 Daisy Chain
Note: J1 would only be used for RS232C input at the first X110 in the daisy chain. The dotted line represents an optional RS422/485 connection directly from the host.

When connecting a host device it is important to note that X110s appear as Data Communications Equipment (DCE) as opposed to Data Terminal Equipment (DTE). In practical terms, this means that most display terminals can be connected to an X110's RS232 port with straight pin-for-pin cable on pins 1, 2, 3 and 7. X110s do not require handshaking but present the signals Clear To Send (pin 5), Data Set Ready (pin 6) and Data Carrier Detect (pin 8) at a "Mark" level of +10VDC.

J1 (DB25): A 25-pin, female, D-type, connector for use with RS232C or Current Loop. This port can be used when configuring an X110 from a terminal or PC. It can also serve as the first connection from a host device into the built-in RS485 conversion logic so that point-to-point RS232 or Current Loop devices automatically gain access to the full X110 network.

J2 (DA15): A 15-pin, female, D-type, connector that provides a path for RS422/RS485 linking. If the host device utilizes RS422 or RS485 then the cable connection from this host is to J2 of the very first X110. J1 would be unused. Remaining X110s are daisy-chained through J2 and J3 with J2 as the "In" and J3 as the "Out" socket as shown in Figure 3-3.

J3 (DA15): A 15-pin, female, D-type, connector that acts as the "Out" socket when an X110 is daisy-chained.

X110 COMMUNICATION SIGNAL PIN ASSIGNMENTS

Please observe that X110s are wired as DCE equipment

J1 (DB25) Pin Assignments RS232-C or Current Loop			J2/J3 (DA15) Pin Assignments RS422 or RS485	
J1 - 1	Prot. Gnd.	(shield)	J2/J3 - 1	DATA IN- (Host TXD-)
J1 - 2	RXD	(input)	J2/J3 - 2	DATA IN+ (Host TXD+)
J1 - 3	TXD	(output)	J2/J3 - 3	DATA OUT- (Host RXD-)
J1 - 4	RTS	(input)	J2/J3 - 4	DATA OUT+ (Host RXD+)
J1 - 5	CTS	(input)	J2/J3 - 5	RTS IN-
J1 - 6	DSR +10	(output)	J2/J3 - 6	RTS IN+
J1 - 7	GROUND		J2/J3 - 7	CTS OUT-
J1 - 8	DCD +10	(output)	J2/J3 - 8	CTS OUT+
J1 - 9	REC CL+	-current loop	J2 - 9	GROUND (Shield)
J1 - 10			J2/J3 - 10	FLSH SYNC+
J1 - 11	REC CL-	-current loop	J2/J3 - 11	FLSH SYNC-
J1 - 12			J2/J3 - 12	N/U
J1 - 13	CTS ret	-current loop	J2/J3 - 13	N/U
J1 - 14			J2/J3 - 14	N/U
J1 - 15	RTS/DTR ret	-current loop	J2/J3 - 15	N/U
J1 - 16				
J1 - 17				
J1 - 18	TR CL-	-current loop		
J1 - 19				
J1 - 20	DTR	(input)		
J1 - 21				
J1 - 22				
J1 - 23				
J1 - 24	DSRS	(opt. output)		
J1 - 25	TR CL+	-current loop		

Figure 3-4 Communication Pin Assignments for the X110 Interface Ports

3.4 System Configuration

This section goes into detail about the X110 system configurations and explains how to configure each X110 of the network. There are several network configurations shown in the following pages that describe the jumper settings, switch settings and cable details necessary to setup an X110 network. These configurations are the most common for an X110 system, but this is not the limit of possibilities for the X110 network.

A number of jumpers and DIPswitches are used to adapt the X110 to a variety of operating conditions. There is a customary setting for most of these jumpers and switches. For a majority of users, this means that only five termination jumpers (W3, W4, W5, W6 and W14) will vary. These five jumper settings depend on the physical position of the X110 in the daisy chain. Typical jumper and switch settings are described below.

Since the issue of terminating jumpers can be confusing, Ronan has developed termination plugs that attach directly to the X110 when termination is needed. These termination plugs replace the termination jumpers and have Ronan part number X110-1012. They attach directly to the X110 communication ports, J2 and J3, and will be shown in the diagrams in the pages to follow.

3.4.1 Typical X110 System Configurations

Figures 3-6, 3-7, 3-8 and 3-9 depict complete jumper settings, switch settings and cabling for the X110 units. Some general guidelines for the jumper settings and functions of the switch, SW1, are discussed below.

3.4.2 Typical Jumper Settings

The following jumpers must be in place (ON) for all X110 units in the string.

W8- (232)
W9- (DTR)
W10- (ON)
W11- (ON)
W15- (ON)
W17- (ON)
W18- (232)
W20- (232)
W21- (232)
W22- (A)
W29- (A)

If the current loop is used to communicate with the host computer, only the first X110 in the string of X110s will change the jumpers W8, W18, W20 and W21 to the CL setting of that jumper before.

W8- (CL)
W9- (DTR)
W10- (ON)
W11- (ON)
W15- (ON)
W17- (ON)
W18- (CL)
W20- (CL)
W21- (CL)
W22- (A)
W29- (A)

3.4.3 Termination Jumpers

W3, W4, W5, W6, W14

On the last X110 in the chain, install W3- (middle AB), W4- (middle AB), W5- (middle AB), and W6- (middle AB) and install W14.

On the first X110 in the chain:

1). If the communication with the host computer is set for Current Loop or RS232, install W3- (middle AB), W4- (middle AB), W5- (middle AB), W6- (middle AB) and install W14.

2). If the communication with the host computer is set for RS422/RS485, do not install W3, W4, W5 and W6. Only install W14.

Use the following switch setting if the X110N (new X110) is used.
The U40 on the X110N is labled as (X110LULU?? U40).

SW1	ON	OFF
1	Refer to table 1	Refer to table 1
2	Refer to table 1	Refer to table 1
3	Refer to table 1	Refer to table 1
4	Refer to table 1	Refer to table 1
5	EEPROM is write protected	EEPROM can be written
6	RS422/RS485	RS232/CL
7	Master	Slave
8	Configration mode	Run mode

X120 Muxes in the system	SW1-1	SW1-2	SW1-3	SW1-4
1	ON	ON	ON	ON
2	OFF	ON	ON	ON
3	ON	OFF	ON	ON
4	OFF	OFF	ON	ON
5	ON	ON	OFF	ON
6	OFF	ON	OFF	ON
7	ON	OFF	OFF	ON
8	OFF	OFF	OFF	ON
9	ON	ON	ON	OFF
10	OFF	ON	ON	OFF
11	ON	OFF	ON	OFF
12	OFF	OFF	ON	OFF
13	ON	ON	OFF	OFF
14	OFF	ON	OFF	OFF
15	ON	OFF	OFF	OFF
16	OFF	OFF	OFF	OFF

Table 1

On the X110s between the first and last units, do not install W3, W4, W5, W6 and W14.

Reminder: If the X110 termination plugs, Ronan part number X110-1012, are used do not install W3, W4, W5, W6 and W14 on any of the X110s in the string.

3.4.4 Typical Switch Settings

Note: If the X110 is using LULU Firmware (57600 baud rate), use the switch settings shown on Page 13.

The X110 has one row of eight DIP switches, called SW1, which must be set before any X110 can communicate with the host computer. The following describes the function of SW1.

Refer to Figure 3-5 for a quick look-up table for switch settings.

SW1-1 and SW1-2 determine the baud rate for the X110. The X110 must be set to the host computers, baud rate. The following switch settings determine the baud rate used by the X110.

BAUD RATE	SW1-1	SW1-2
1200	OFF	OFF
2400	ON	OFF
4800	OFF	ON
9600	ON	ON

NOTE:

- 19,200 baud can only be selected through the configuration menu.
- Baud rate and parity parameters can be set in the X110 Configuration Mode and stored in non-volatile memory (EEprom). If these parameters are set in Configuration Mode, then the external switches will only be active when Local Configuration is invoked.

SW1-3 and SW1-4 determine the parity of the communication between the X110 and the host computer. The options are as follows:

PARITY	SW1-3	SW1-4
NONE	OFF	OFF
EVEN	ON	OFF
ODD	ON	ON

SW5 allows the contents of the non-volatile ram to be protected from accidental erasures or from non-authorized erasures.

PROTECTION	SW1-5
YES	ON
NO	OFF

SW1-6 selects the electrical communication interface that is to be used between the X110 and the host computer. When SW1-6 is OFF the RS232C or Current Loop is the chosen interface (the jumper settings determine which interface is used). When SW1-6 is ON, then RS422/RS485 is the selected interface.

ELECTRICAL INTERFACE	SW1-6
RS232 or Current Loop	OFF
RS422/RS485	ON

NOTE:
Typically, the first X110 in the string converts the signal from the host computer to the X110 default communication standard of RS422/RS485.

SW1-7 controls the selection of the communication master. The communication master controls any communication between the host computer and the string of X110s.

MASTER	SW1-7
NO	OFF
YES	ON

NOTE:
- There should only be one X110 configured for the communication master. If there is more than one master selected there could be communication faults!
- The communication master is always the last one in the X110 string (the X110 farthest from the host computer).

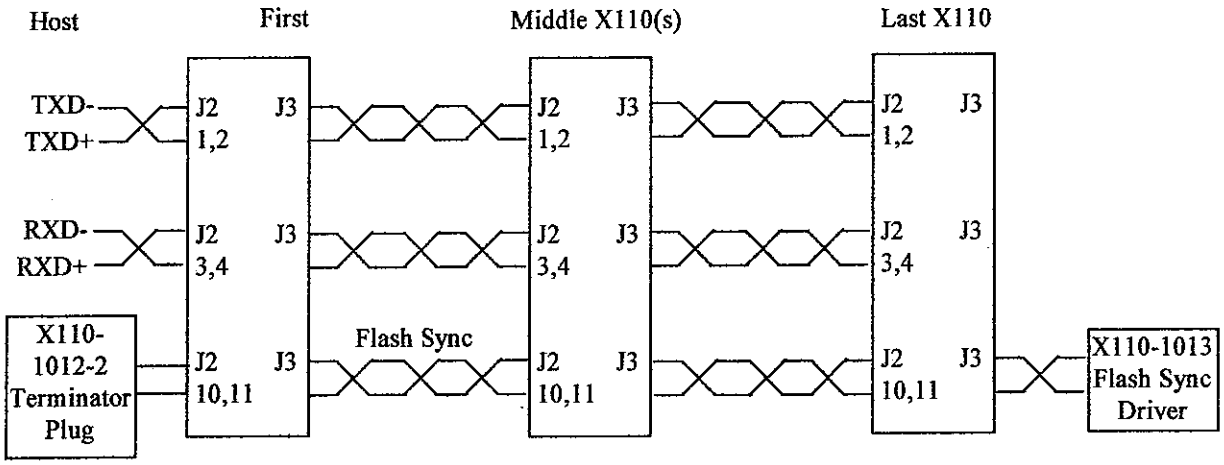
SW1-8 is used to switch between local Configuration Mode and Run Mode. This switch is usually OFF.

MODE	SW1-8
CONFIGURATION	ON
RUN	OFF

NOTE:
When attempting Local Programming, all communication cables (except the terminal cable, J1) must be disconnected from the X110 controller communication ports, J2 and J3.

S-8	*S-7*	*S-6*	*S-5*	*S-4*	*S-3*	*S-2*	*S-1*	*DESCRIPTION*
						off	off	- 1200 baud
						off	on	- 2400 baud
						on	off	- 4800 baud
						on	on	- 9600 baud
				---	off			- no parity
				off	on			- even parity
				on	on			- odd parity
			off					- EEprom can be written
			on					- EEprom is WRITE PROTECTED
		off						- RS232 or current enabled
		on						- RS422/485 enabled
	off							- This X110 is NOT the Master
	on							- This X110 is the master
off								- This X110 is in the Run Mode
on								- This X110 is in the Configuration Mode

Figure 3-5 SW1 Switch Settings

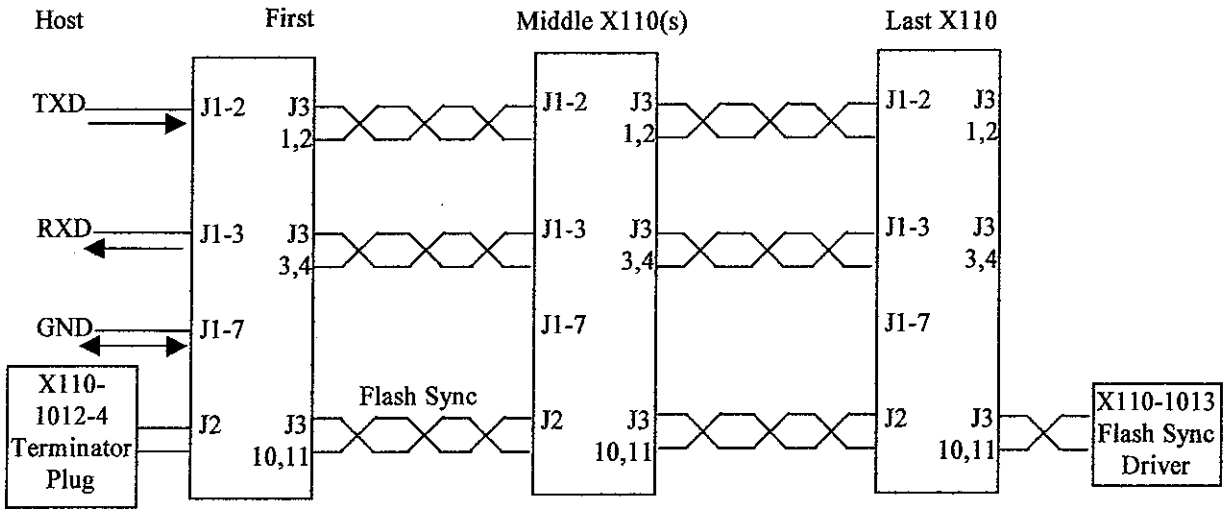


SW1-1 TO SW1-4 DEPENDS ON HOST COMPUTER COMMUNICATION		
SW1-5 (OFF)	SW1-5 (OFF)	SW1-5 (OFF)
SW1-6 (ON)	SW1-6 (ON)	SW1-6 (ON)
		SW1-7 (ON)
		*W3 (MIDDLE)
		*W4 (MIDDLE)
		*W5 (MIDDLE)
		*W6 (MIDDLE)
W8- (232)	W8- (232)	W8- (232)
W10, W11	W10, W11	W10, W11
*W14		*W14
W15, W17	W15, W17	W15, W17
W18 (232)	W18 (232)	W18 (232)
W20 (232)	W20 (232)	W20 (232)
W21 (232)	W21 (232)	W21 (232)
W22 (A)	W22 (A)	W22 (A)
W26 (A)	W26 (A)	W26 (A)
W27 (B)	W27 (B)	W27 (B)
W29 (B)	W29 (B)	W29 (B)
W30 (B)	W30 (B)	W30 (B)

Figure 3-6
Cabling with Run Mode Switch and jumper settings shown for use with RS422/485 Host Communications

**** These jumpers are not used when termination plugs are used.***

NOTE: The cable does not contain wiring for CTS or RTS. Pins 5 & 6 and 7 & 8 of the cables to P2/P3 should not be wired. If wiring is present, remove the W4 and W5 jumpers in all but the last X110.



SW1-1 TO SW1-4 DEPENDS ON HOST COMPUTER COMMUNICATION		
SW1-5 (OFF)	SW1-5 (OFF)	SW1-5 (OFF)
SW1-6 (OFF)	SW1-6 (ON)	SW1-6 (ON)
		SW1-7 (ON)
*W3 (MIDDLE)		*W3 (MIDDLE)
*W4 (MIDDLE)		*W4 (MIDDLE)
*W5 (MIDDLE)		*W5 (MIDDLE)
*W6 (MIDDLE)		*W6 (MIDDLE)
W8- (232)	W8- (232)	W8- (232)
W10, W11	W10, W11	W10, W11
*W14		*W14
W15, W17	W15, W17	W15, W17
W18 (232)	W18 (232)	W18 (232)
W20 (232)	W20 (232)	W20 (232)
W21 (232)	W21 (232)	W21 (232)
W22 (A)	W22 (A)	W22 (A)
W26 (A)	W26 (A)	W26 (A)
W27 (B)	W27 (B)	W27 (B)
W29 (B)	W29 (B)	W29 (B)
W30 (B)	W30 (B)	W30 (B)

Figure 3-7
Cabling with Run Mode Switch and jumper settings shown for use with RS232 Host Communications

**** These jumpers are not used when termination plugs are used.***

NOTE: Connections for CTS, RTS, DSR are NOT required by the X110.

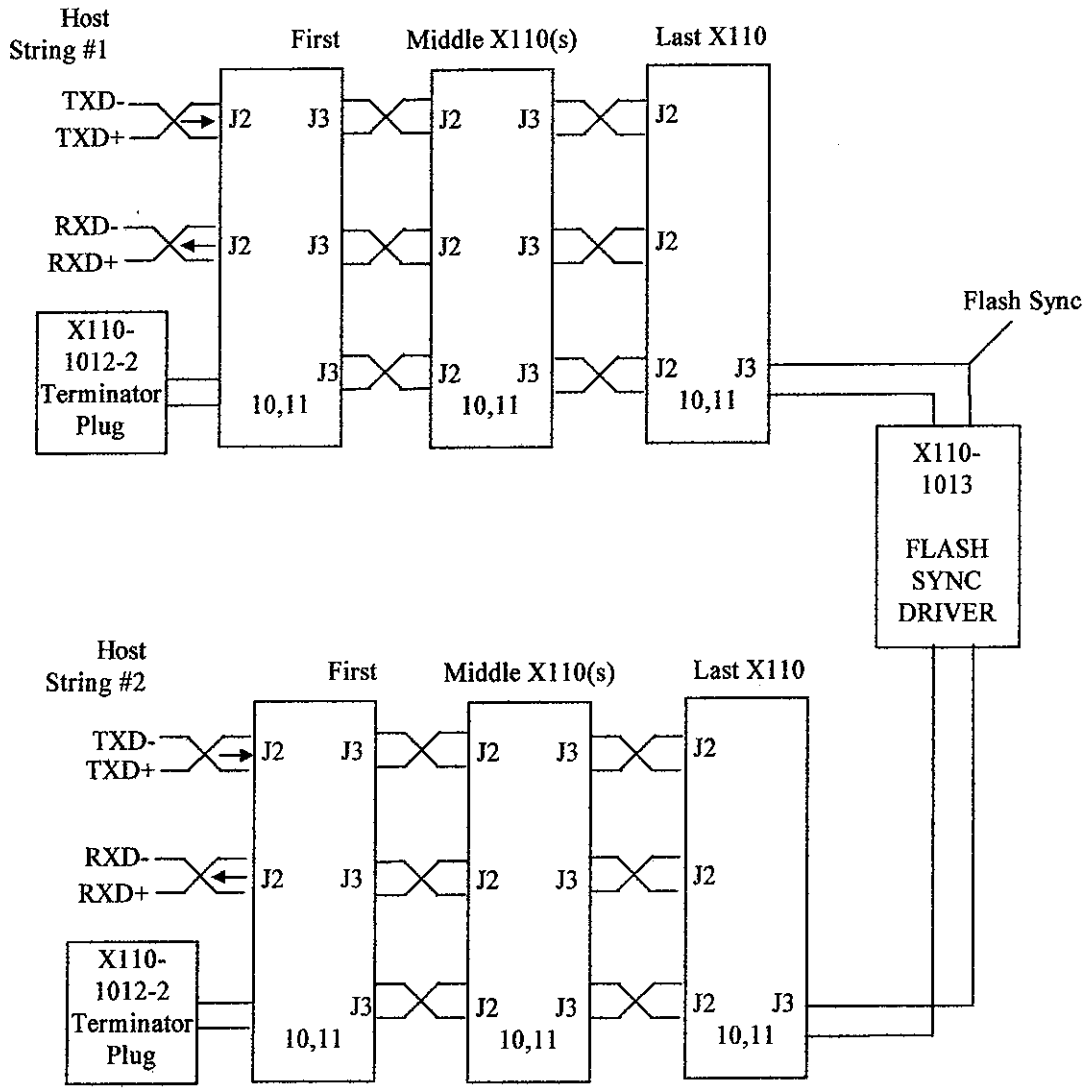


Figure 3-8
Dual X110 strings with common Flash-Sync.
RS422/RS485 input from host computer.

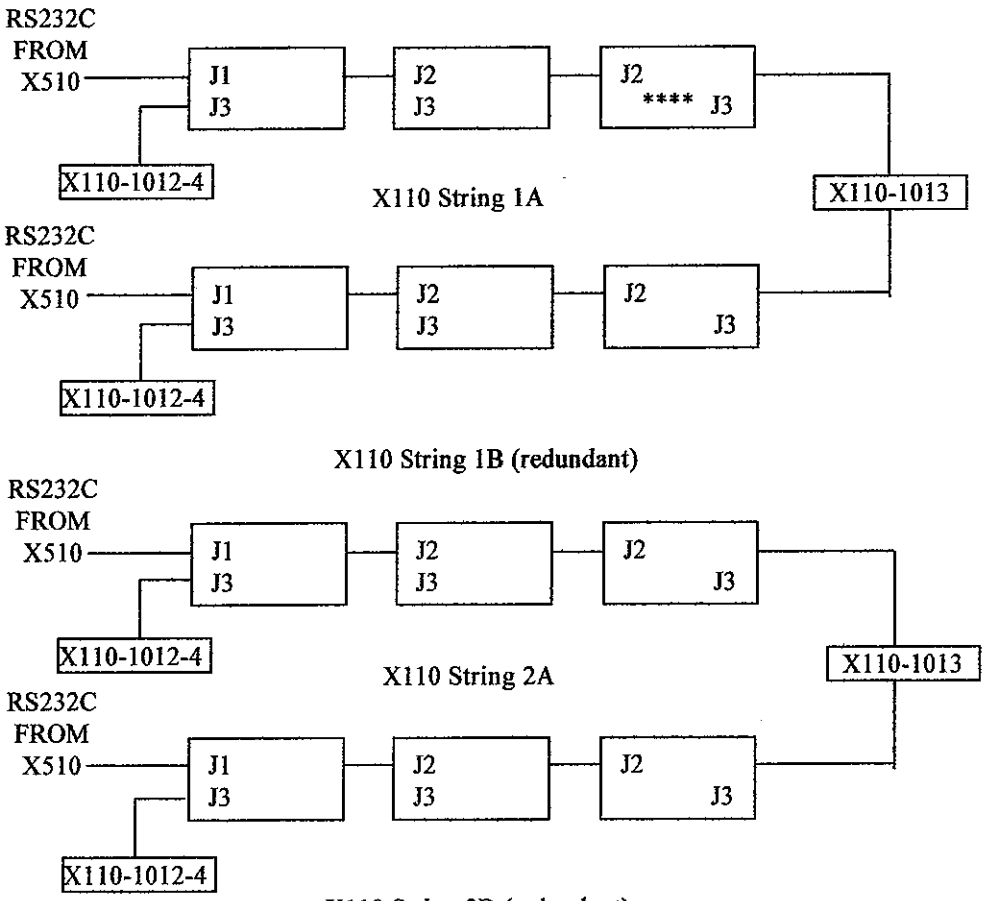


Figure 3-9
Dual X110 strings with common Flash-Sync.
X510 Host computer with RS232C input.

NOTE: this X110 is the only X110 that is programmed as communication master (SW7-ON). All other X110s are non-masters.

Switch Settings for X110s With LULU Firmware (57600 baud-rate)

The Master X110 scans all the Multiplexers (Max. 16) in the string one at a time. The SW1-1 to SW1-4 represents the number of X120 Muxes to be scanned as shown below:

SW1-1	SW1-2	SW1-3	SW1-4	No. of X120s
ON	ON	ON	ON	1
OFF	ON	ON	ON	2
ON	OFF	ON	ON	3
OFF	OFF	ON	ON	4
ON	ON	OFF	ON	5
OFF	ON	OFF	ON	6
ON	OFF	OFF	ON	7
OFF	OFF	OFF	ON	8
ON	ON	ON	OFF	9
OFF	ON	ON	OFF	10
ON	OFF	ON	OFF	11
OFF	OFF	ON	OFF	12
ON	ON	OFF	OFF	13
OFF	ON	OFF	OFF	14
ON	OFF	OFF	OFF	15
OFF	OFF	OFF	OFF	16

SW1-5 = ON EEPROM is write protected
SW1-5 = OFF EEPROM can be written

SW1-6 = ON RS422/485 enabled
SW1-6 = OFF RS232 or Current Loop enabled

SW1-7 = ON Master
SW1-7 = OFF Slave

SW1-8 = ON Configuration Mode
SW1-8 = OFF Run Mode

The communication parameters in CONFIGURATION mode are: 9600,N,8,1
The communication parameters in RUN mode are: 57600,N,8,1

Note: The above settings are not the same for a standard X110.

SECTION 4 - X110 SOFTWARE CONFIGURATION

4.0 Setup

An X110 needs to be provided with run-time parameters, which are then saved in its E^2PROM. These define the point-to-window assignments, the selected sequence(s), and other operational details. The parameters are entered or modified during a configuration session that is conducted either "off-line" (where the X110 is isolated from other X110s on the party-line), or "on-line" (where the X110 remains connected on the party-line but responds to a special selection process that places it in the configuration mode).

If this configuration session is to be an entirely new one, it is recommended that the user "clear" the E^2PROM of all previous information. Selecting a "D" from the menu and executing diagnostic number 4 will do this.

4.1 Off Line Configuration

The X110 that is to be configured should be isolated from all other X110s by removing the cables from J2 and J3. A single cable connection should be made from the X110 to the terminal that will be used in the configuration session.

If the terminal communicates via RS232C, connect a cable (as shown in Figure 4-2) between the terminal and the 25-pin socket, J1, on the X110. Set SW1-6 "OFF" disabling RS422/485 and enabling RS232.

If the communication between the terminal and the X110 is by RS422/485 disconnect J1 and J3 and connect a single cable from the terminal to J2 of the X110 (as shown in Figure 4-3). Set SW1-6 "ON" disabling RS232 and enabling RS422/485.

Set SW1-5 "OFF" disabling the E^2PROM Write Protect. Set SW1-7 and SW1-8 "ON": these set the X110 to the Master and Configuration Mode respectively.

The baud-rate and parity are selective by means of the dipswitch, SW1, located on the X110 controller. The baud rate in off-line Configuration Mode is limited to 9600. The functions of the switch, SW1, are given in Figure 3-5. Communication data characters must be 7-bit ASCII with odd, even or no parity and 1 or 2 stop bits.

After setting SW1-8 to ON, the X110's Main Menu is transmitted to the terminal and will appear on the screen as shown in Section 4.3.

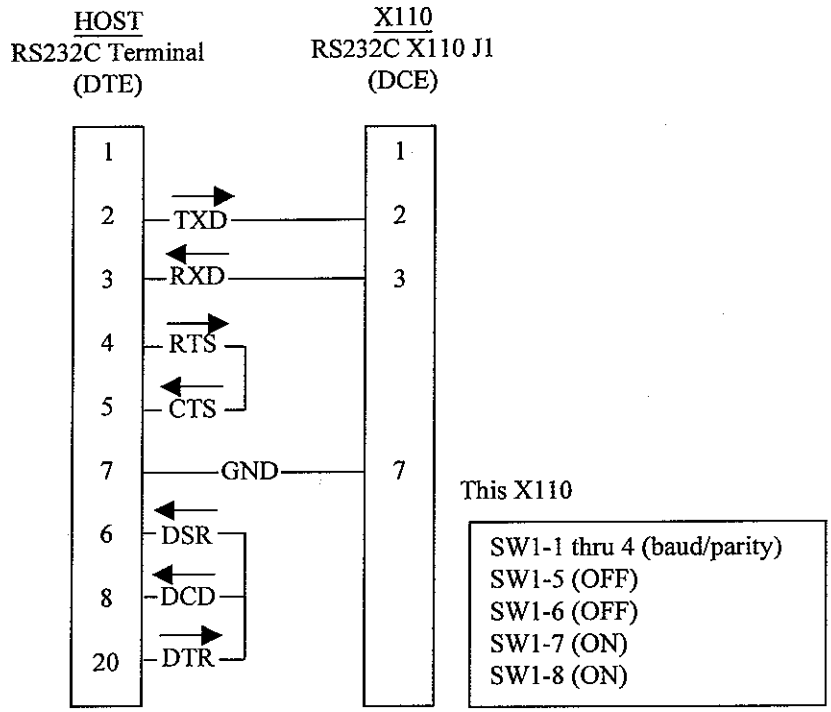


Figure 4-2
RS232C Cable from Host Terminal to J1 of the X110
NOTE: The Host Cable may not actually require all of the local connections shown for 6, 8, 20 and 4, 5.

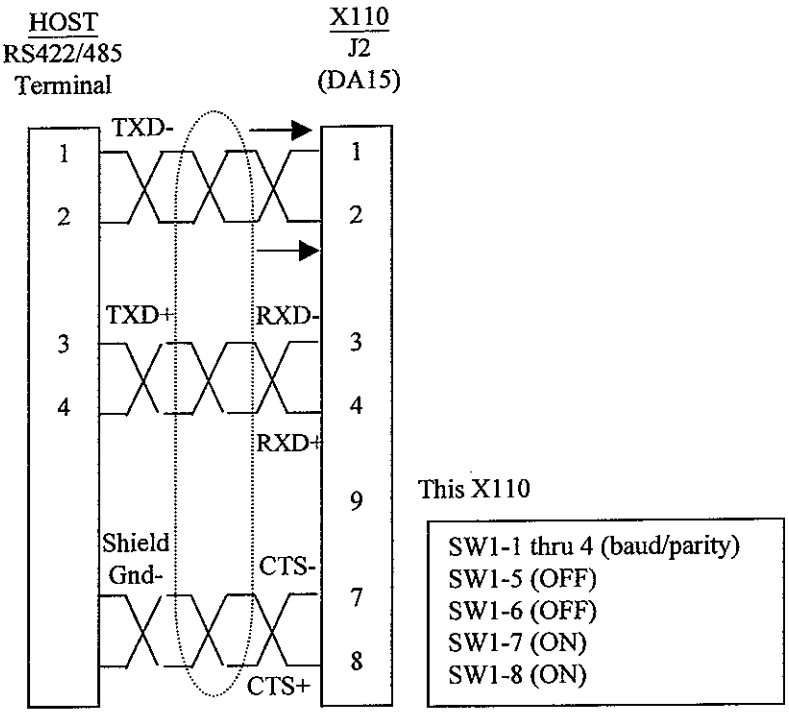


Figure 4-3
RS422/485 Cable from a Host Terminal to J2 of the X110.

4.2 On Line Configuration

X110s may be reconfigured while "on-line". The communicating device used for configuring should use the same type of communication circuitry and baud rate, as does the normal run-time host (RS232C, RS411/485, or Current Loop). In some cases, the configuration process may be done directly from the host but it is more likely that a separate terminal device will be needed. The terminal can be placed in service on the party line in place of the normal run-time host.

The actual configuration phase is preceded by a UNIT selection phase, which allows the operator to select the X110 that is to be configured. This selection can be made by addressing the X110 with a pre-assigned UNIT NUMBER.

4.2.1 Selecting the X110

Party-lined X110s enter the selection phase if they receive the two ASCII characters "ESC M" followed by the single character "CTRL-P" (DLE). All of the X110s on the line will leave the run mode and STOP LOOKING FOR ALARM MESSAGES. The Master X110 will ask the operator to select the X110 that is

to be configured which is done by entering "Uxxx" followed by a carriage return - where xxx is a UNIT number from 1 to 256.

The selected X110 will light all of its lamps (as though the Test Button and been pressed). If the correct unit is selected the operator enters a "Y". The user should enter an "N" if the selected unit is incorrect and the selection process will start again. Communication control will pass from the normal Master X110 to the one selected for configuration. Interactive menu dialogue will take place until the user "Q"uits the Main Menu and types "X" followed by a carriage return to eXit ON LINE configuration. An alternative way of leaving X110 ON LINE configuration is to type a "CTRL-D" character, which will send the X110 back to alarm mode and accepting alarms. At this time the user may select another X110 by entering, once more, the two characters "ESC M" followed by the single character "CTRL-p".

NOTE: If a typographical error or incorrect response is made while accessing ON LINE configuration, the X110 will signal that an inappropriate answer was given and it will proceed to ask the question again.

4.3 Interactive Configuration

The user tailors the X110 to meet the needs of a particular site application during an interactive, menu-driven, configuration session with the X110. The following sections display the typical interaction between the operator and the X110. The operators responses appear as **HIGHLIGHTED** characters.

4.3.1 Main Menu

The X110 Main Menu notifies the operator that the X110 is functional by displaying the X110 banner and by displaying the current revision of the X110 firmware. At this point, the X110 offers the operator a large selection of menus from which to choose.

Each of the possible Main Menu choices is fully explained along with examples in the following pages.

```
RONAN X110 ANNUNCIATOR
Configuration Mode Active
Select Operation then enter Carriage Return:

Version:   COMRD04    Date:  May 16, 1991

H -X110 Host Computer (X120, X500, X510, X1000)
U -Unit Number Assignment
C -Communication Parameters
P -Pattern Recognition Parameters
W -Set Window Assignments
F -First Out Group Assignments
L -List all Window Assignments
V -View Individual Window Assignments
M -Audibles and Options
D -Diagnostics
Q -Exits X110 Configuration Mode

Enter Selection:
```

4.3.2 Selecting an X110 Host Computer: "H"

If "H" is selected the X110 requests the operator to select the host computer that will communicate to the X110. This will set up the parameters (communication, alarm patter) of the X110 to the Ronan default values for the specific device that was selected. If the X110 host is not a Ronan product, the X110 gives an option for a non-Ronan product.

The following shows the operator in the Host Setup Menu changing the selection of the host computer from an X500 to an X1000:

```
Host Setup Menu:

"Q" will return to main menu
The current host computer is an X1000

Available host options are:

1 -X120
2 -X500
3 -X510
4 -X1000
5 -OTHER

Select a host computer interface:  4 ↵
```

NOTE: Most of the parameters (communication baud rate and pattern recognition parameters) that are needed to accept alarms from the selected host computer are done with this command, but not all of them can be automatically selected. The unit number, any X110 operations, X110 string position and other parameters, which affect the X110 operation, must also be selected.

4.3.3 Unit Number Selection: "U"

Every X110 requires a unique identification number. This number is used when the X110 is addressed during ON LINE Configuration. This number represents the individual address of a single X110 in a string of X110s. The range of values allowed is between 1 and 256.

The following menu is the Unit Number Assignment Menu that allows the unit number to be changed. In the following example, the operator changes the value of the X110 unit number from 1 to 35.

```
Host Setup Menu:

"Q" will return to main menu
The current host computer is an X1000

X110 UNIT NUMBER ASSIGNMENT
"Q" will return to main menu

The current unit number assigned to this X110 is 1

Enter the unit assignment number for this X110.
 (The range is 1 through 256):  35 ↵
```

4.3.4 Communication Parameters: "C"

The X110 communication parameters determine how the X110 is going to communicate to the host computer. Specifically, the X110 needs to know what baud rate and parity is to be used by the host and whether or not there is to be any handshaking. The X110 also needs to know if it is going to be selected as the electrical signal converter between the host signal and the X110 network. Is this X110 is going to act as a signal converter from an RS232 or Current Loop host computer? Finally, the X110 must be informed about synchronization of lights between the X110 controllers and whether or not it is to control the synchronization (is this X110 going to act as a flashmaster?

The Communication Parameter Menu first displays the current configuration of the X110 and then queries the operator. The following example changes the baud rate of the X110 system to 2400 baud, allows the X110 to have its lights synchronized, and is selected to be the first X110 to interface to an RS232 host.

```
COMM PARAMETERS:
"Q" will return to main menu

Present settings are:
Buad=9600  Data=7  Parity=even  Handshake=none
Echo=none  Protocol=none  Comm Retries=0
FlashSync is disabled.
It is not the first RS232 in a daisychain.
This X110 is attached to an X1000

Available Baud Rates are:  1-1200  2-2400  3-4800  4-9600  5-19200
                           6-SWITCH SELECTABLE
Enter number 1-6 to select baud rate:  2 ↵

Enter number of Data bits 7 or 8:  7 ↵

Enter Parity selection
O for Odd, E for Even, or N for none:  E ↵

Hardware-handshake with CTS/RTS or CTS/DTR available
Enter "Y" or "N" for Hardware-Handshake:  N ↵

Enter "Y" or "N" for Echo:  N ↵

FlashSync synchronizes the flashing of different X110 lamp cabinets.
Enter "Y" if FlashSync is needed:  Y ↵

Enter "Y" or "N" for this X110 if it will be
active as the FIRST RS232 in a Multiple unit daisychain:  Y ↵
```

4.3.5 Patter Recognition: "P"

The Pattern Recognition Parameters allow the X110 to choose the ASCII characters that will trigger an X110 to go into an alarm state or into a normal state. The X110 has the capability of accepting two characters to represent the Alarm and Normal State of a point. For example, the X1000 must transmit to the X110 the character "A" for an Alarm state to be triggered by the X110 and the character "N" for the X110 to trigger a normal state.

NOTE 1: When you choose the X120, X500, X510 or X1000 as a host computer, the X110 automatically will set the patter recognition to the desired parameters and you do not have to change anything in selection "P" which is Pattern Recognition.

NOTE 2: A host computer must be selected from the Host Computer Menu before adjusting any pattern characters in this menu. This menu will change appearance depending on which host computer is selected. Also, note that the question, which asks for a present point identifier, should always be answered NO.

The following menu shows the present status of patters that the X110 is setup to recognize as valid alarms. In this case, the X110 is setup to receive alarms from an X1000.

```
PATTERN RECOGNITION:
"Q" will return to main menu

Present status patterns are:  ALARM=A  NORMAL=N
Present point number identifier is:  none
Points are represented as Mux/Chan
Enter "Y" if you wish to alter a pattern:  N ↵

Enter "Y" to select the "#" as a point number
identifier:  N ↵
```

4.3.6 Creating Window Assignments: "W"

The Creating Window Assignment Menu provides this means for assigning point numbers and a sequence type to each window. If the host computer was selected as either X500, X510 or X1000 the alarms will be in Mux/Channel format. If the host computer was selected as X120, the alarms will be in point number format.

The following example illustrates how the point number, mux/channel number or sequences could be assigned to a window:

Example 1: The host computer is chosen as an X500, X510 or X1000.

```
CREATE WINDOW MENU:
"Q" will return to main menu

Enter window number 1-48:  11 ↵

Sequence selection       Present Sequence type is AAWSM

Available sequences are:
1=A  2=F1A  3=F2A  4=F3A  5=A/4  6=A/5,6  7=M  8-F1M
9=F2M  10=RFL  11=RDSH  12=RMD1  13=F1R  14=F2R  15=F3R  16=RDSMD1
17=R  18=APRM  19=AAWSM  20=SP1  21=SP2  22=20F4  23=F3M  24=SP5
Enter number 1-24 to select sequence:  7 ↵

Add, delete or view points associated with this window and this X110
Enter "A" to add; "D" to delete; "V" to view:  A ↵

Enter Mux number 0-31:  2 ↵
Enter Channel number 0-127:  36 ↵
Enter Mux number 0-31:  "The {enter key} will give you window selection again."
                        "The {Q key} will return to main menu."
```

Example 2: The host computer is chosen as an X120.

```
CREATE WINDOW MENU:
"Q" will return to main menu

Enter window number 1-48:  11 ↵

Sequence selection       Present Sequence type is AAWSM

Available sequences are:
1=A  2=F1A  3=F2A  4=F3A  5=A/4  6=A/5,6  7=M  8-F1M
9=F2M  10=RFL  11=RDSH  12=RMD1  13=F1R  14=F2R  15=F3R  16=RDSMD1
17=R  18=APRM  19=AAWSM  20=SP1  21=SP2  22=20F4  23=F3M  24=SP5
Enter number 1-24 to select sequence:  7 ↵

Add, delete or view points associated with this window and this X110
Enter "A" to add; "D" to delete; "V" to view:  A ↵

Enter point number 1 - 9999:  715 ↵
Enter point number 1 - 9999: ↵
```

NOTE 1: The point number format for X120 is XXYY, where XX=mux number (1-32) and YY=channel number (1-48), therefore the points for X120 mux number 1 are from 0101 to 0148 and for mux number 12 are from 1201 to 1248.

NOTE 2: If zero is the first digit of the point number, you don't have to enter that digit. Point number 0128, for example, would be entered as 128.

4.3.7 First Out Groups: "F"

First-Out-Groups are given unique ID numbers (from 1 to 50) and within the X110 these ID numbers are attached to each window and any point in that window.

First Out Groups are assigned during the Create Window Assignment Menu when first out sequences are selected. However, these may not encompass the entire First Out Group since some points may be assigned to other X110s in the X110 network.

It is possible for a portion of a First Out Group to be assigned to windows in other X110s. This is permitted provided the X110s are daisy-chained and all points relating to a First-Out-Group are known to all the X110s involved with the F.O.G.; therefore, every single point that is a member of a particular F.O.G. must be identified in each X110 that contains any part of the F.O.G.

This example illustrates the addition of Point Number 2016 to the First Out Group identified as 14. Point 2016 is monitored by another X110 in the network, but it belongs to First Out Group 14. This X110 must be informed of any new points that are assigned to any of its First Out Groups. Please note that the points which are monitored by this X110 are indicated by a "*" character and all other points are monitored by other X110s in the network. First Out Groups are "V"iewed beforehand.

```
FIRST-OUT-GROUP ASSIGNMENT:
"Q" will return to menu

Enter First-Out-Group # associated with an external X110 (1-50):
2 ↵
Enter "A" to add; "D" to delete; "V" to view:  V ↵

Points with a "*" indicate that they are assigned to this X110
Point(s)= *00035  *01036  05041  09235

Enter "A" to add; "D" to delete; "V" to view:  A ↵
Enter point number 1 - 9999:  2016 ↵
Enter point number 1 - 9999: ↵

Enter First-Out-Group Number 1 - 99:  Q ↵
```

4.3.8 List All Window Assignments: "L"

The List All Window Assignments Menu displays a complete list of all window assignments and parameters that apply to a particular X110 window. The point assignments are shown on a window basis starting with window 1 and ending with window 48.

The format for each window is:

Window ## Sequence Type is yy
Point(s)= xxxxx xxxxx xxxxx or Point(s)= mm/ccc mm/ccc

The X110 displays eight windows for each screen and then waits for the operator to press the carriage return button to display the next eight windows. After the 48th window has been displayed, the status for the communication parameters and pattern recognition parameters are shown. Once the communication and pattern parameters are displayed, entering a carriage return will restore the Main Menu.

The following is an example of what would be displayed when selecting the List All Window Assignment Menu.

```
      WINDOW 1  Sequence type is A
Mux/Chn(s)= 0/1  23/45
      WINDOW 2  Sequence type is A
Mux/Chn(s)= 0/2
      WINDOW 3  Sequence type is AAWSM
Mux/Chn(s)= 0/3
      WINDOW 4  Sequence type is AAWSM
Mux/Chn(s)= 0/101
      WINDOW 5  Sequence type is unassigned
Mux/Chn(s)=
      WINDOW 6  Sequence type is unassigned
Mux/Chn(s)=
      WINDOW 7  Sequence type is unassigned
Mux/Chn(s)=
      WINDOW 8  Sequence type is unassigned
Mux/Chn(s)=

Press RETURN key to continue list
```

NOTE: Depending on what host computer was selected, the X110 will display point assignments in either a point format or a Mux/Channel format.

4.3.9 View Individual Window Assignment: "V"

The View Individual Window Assignment Menu displays the parameters that have been assigned to the window depicted.

The following example shows the parameters, which have been programmed for window 1.

```
Enter window number 1-48:  1 ↵
Mux/Chn(s)=  01/  23/45
Sequence type is A

Enter window number 1-48:
```

4.3.10 Audibles and Options: "M"

The Audibles and Options Menu allows the operator to select special options that are available with the X110. The current state of the options is displayed and can be toggled by entering the option number at the prompt.

The following is the display that is shown when the Audibles and Options Menu is entered.

```
Audibles and Options Menu:
"Q" will return to main menu

Present options settings are:

       7-Automatic Alarm Silence is OFF
       9-Automatic Ringback Silence is OFF
      10-X500 watchdog timer is OFF
      11-X510 watchdog timer is OFF
      12-X110's point capacity is 240 points per X110
      13-Ripple Test is DISABLED
      14-X120 watchdog timer is OFF

Enter number 7-14 to toggle options:
```

Option 7, when in the ON state, allows the X110's horn relay to automatically silence itself after 5 seconds.

Option 9, when in the ON state, allows the X110's ringback relay to automatically silence itself after 5 seconds.

Option 10, when in the ON state, allows the X110 to monitor the communication line of the X500. The X110 checks for a connection between itself and the X500 by looking for a special ASCII character periodically. If the character is not received after 2 minutes, the X110 will flash all of its lamps on and off.

Option 11, when in the ON state, allows the X110 to monitor the communication line of the X510. The X110 checks for a connection between itself and the X510 by looking for a special ASCII character periodically. If the character is not received after 5 seconds, the X110 will flash all of its lamps on and off.

Option 12, allows the operator to select the point capacity of the X110. On the standard setting, the X110 can handle 240 points with full first out group capability. If the non-standard mode is selected, the X110's point capacity is increased to 480 points with the limitation that no first out group sequences can be used.

Option 13, when ENABLED stops the ripple tests on power up and reset of the X110. It also prevents the communication error flashing from occurring. If this option is DISABLED, the ripple test does occur on power up and reset. This feature is useful when relays are driven by the X110 outputs instead of lamps.

Option 14, when in the ON state, allows the X110 to monitor the communication line of the X120. The X110 checks for a connection between itself and the X120 by looking for a special ASCII character periodically. If the character is not received after 5 seconds, the X110 will flash all of its lamps on and off.

4.3.11 Diagnostics: "D"

The Diagnostics Menu allows the operator to execute several diagnostic tests and erases the current contents of the X110 database.

The following is the Diagnostics Menu:

```
DIAGNOSTICS:
"Q" will return to main menu

Available Diagnostics are:
  1= Ripple lamps
  2=Stop ripple lamp test
  3=TEST and CLEAR EEPROM !CONTENTS WILL BE LOST!
  4=CLEAR EEPROM !CONTENTS WILL BE LOST!
  5=RAM test
  6=EEPROM update
Enter number 1-6 to select diagnostic: Q
```

Diagnostic 1 starts the ripple test, which tests the integrity of the communication between the communication processor and the lamp processor. It also tests the lights to make sure they are functioning.

Diagnostic 2 stops the ripple test.

Diagnostic 3 does an EEPROM test by writing and reading from every location of the EEPROM. If any error occurs, the bad location is displayed. This test erases the contents of the X110 database! The X110 prompts the operator to verify this selection.

Diagnostic 4 erases the entire X110 database without testing the EEPROM. The X110 prompts the operator to verify this selection.

Diagnostic 5 does a RAM test. If an error occurs, the bad location is displayed.

Diagnostic 6 examines the contents of the X110 database and verifies that there are no inconsistencies in the database. These diagnostics was developed after some problems arose in early releases of the X110 firmware and are used on old systems that are upgraded. These data base inconsistencies do not exist in later versions of firmware.

4.3.12 Quit: "Q"

Entering a "Q" at appropriate times in the menu dialogue results in an exit from the current level of menu activity. There are two levels of menu activity: level-1 is the Main Menu and level-2 is one of the theme selections from the Main Menu.

If "Q"uit is entered at an appropriate time during level-2 configuration, the X110 returns to level-1 and displays the Main Menu on the terminal's screen.

If "Q"uit is entered as the choice from the Main Menu, the X110 generates a new checksum for data stored in the E^2PROM and leaves the configuration mode.

If the X110 is "OFF LINE", it displays the message "Quitting Configuration Mode. The switch, SW1-8, should be reset to "OFF" to place the X110 in Run Mode". When the X110 recognizes that SW1-8 has been reset to "OFF", it will enter the active run mode. It is recommended that the terminal used for configuring the X110 is removed and the X110 reattached into the Host's serial string before resetting SW1-8.

IF the X110 remained "ON LINE" during configuration mode it displays the message "Press 'X<CR>' to enter ACTIVE MODE:" after entering "Q"uit from the Main Menu. The 'X <CR>' characters should be entered if "ON LINE" configuration is to be terminated and Run Mode re-started.

SECTION 5 - FUNCTIONAL DESCRIPTION

5.0 General

The Ronan Model X110 Annunciator is designed to produce visual and audible response(s) for alarm or normal conditions reported within arriving ASCII messages. The boundaries for these responses are contained in specific configuration parameters that are preset by the user.

X110 Annunciators can be fashioned together in large or small communication networks that appear to a user as a single, modem type device (X110s appear as Data Communications Equipment). For responses to Alarm messages ,the X110 offers not only the complete set of standard ISA alarm sequences but numerous variations and custom sequences as well. A full 9,999 input "Point Numbers" can be recognized or, optionally, 4,096 points represented as "Mux" and "Channel" can be distinguished. Each X110 is able to control 48 display windows (allotted any mix of sequences) and operate Horn, Ringback and Run Relays.

Networked X110s connect as multi-drop, party line units on balanced, twisted pair, communication cable. All X110s receive alarm, normal, and control messages simultaneously. Every X110 screens the contents to determine if it is obliged to react (reaction is based upon a comparison between the point numbers that have been assigned to it and the content of the ASCII message).

5.1 Architecture

The X110 utilizes parallel micro-controllers allowing high-speed communications and message handling coupled with very rapid point comparison and alarm sequence processing.

It is the task of the first micro-controller, the Com_uC, (location U30) to gather all of the run-time parameters during a menu driven configuration session with the user. After these parameters have been obtained, stored and sum-checked in E^2PROM the X110 is able to operate in an active run-time environment. The Com_uC will then manage all communications and determine if an arriving message constitutes an alarm or normal condition and whether or not the message's point number applies to a particular X110. If it has been delegated as the "Master" unit by switch, SW1-7, it will also be responsible for any pre-selected protocol when conducting communication with the host.

The Com_uC monitors SW1-8 for a manual change from the Run Mode to the Configuration Mode or vice-versa. The TEST button is also watched by the Com_uC. When pressed, internal tests take place within both micro-controllers (transparently to any ongoing or incoming alarms) and, if successful, the other micro-controller places all of the connected lamps to the active state (usually ON). The state of all active alarm sequences is retained and status updates continue to be processed in background.

The second micro-controller, the Lmp_uC, (location U1) manages the window-lamps, the horn and run relays and the active alarm sequences. It tracks the current state of all point numbers assigned to its X110 so those duplicate messages cannot effect a sequence that is in progress. It is responsible for all lamp flashing, synchronization, and for monitoring all sequence response buttons (ACK, RESET, SILENCE, FIRST-OUT).

One of the X110's in a daisy chain may be assigned as a flashmaster. If this is done, the Lmp_uC will be responsible for generating the pulse, "FlashSync" that is utilized by the other X110s to coordinate lamp flashing among all the X110 displays. It is worth mentioning that display lamp flashing is not dependent on this pulse. It merely serves to synchronize the different lamp displays if it is present.

Redundant X110 strings operate independently while maintaining a common flashmaster. This application is illustrated in Figure 3-8.

A watchdog-timer circuit is connected to the Lmp_uP, which is responsible for re-triggering this timer provided the Comm_uC sends the correct command at proper intervals. Otherwise, the watchdog-timer will expire forcing a general reset to the X110.

5.2 Host Interface

The host interface for data transmission to the first X110 can be RS232-C, RS422, RS485 or Current Loop. A fiber-optic option is available. If the incoming data is not sent differentially over balanced pair lines (RS422/485) it is converted at the first X110 for use within the X110 network.

5.2.1 Interface Termination

The transmission medium among X110s is balanced, 100 or 120 ohm, twisted-pair, shielded cable that are usually terminated line-to-line in the characteristic impedance of the cable. Line-to-ground termination may be used in extremely noisy environments. Refer to Section 3.4 regarding W3, W4, W5, W6 and W14 for directions on establishing the proper termination.

In order to achieve the most favorable magnetic field protection the communication cable's shield-ground should only connect at the principle receiving plug/socket, P2/J2, in each X110. No shield-ground connection is to be made at P3/J3.

SECTION 6 - DIAGNOSTICS AND TROUBLESHOOTING

6.0 X110 Diagnostics

The X110 has extensive self-test and diagnostic capability. While most test perform automatically after reset or power-on, a number of user initiated tests are accessible from the "D"iagnostic Menu or from external buttons.

6.0.1 Power On

A set of internal diagnostics is activated immediately after power-up or from hardware reset. These diagnostics confirm that the E^2PROM sumcheck is valid, that on board RAM are error free, and that the two microcontrollers operate together. If the X110 is in the Run Mode it will begin generating a "walking" lamp test pattern until it sees either the TEST button, receives a Clear Alarm Command (ESC 4), or receives a message directed specifically to it.

6.0.2 Test Button

The TEST button checks the communication between processors and activates all display lamps (usually this means they are turned ON). While the TEST button is pressed the alarm horn rely and the ringback horn relay are activated and will sequentially energize for approximately 2 to 3 seconds apiece while the TEST button remains pressed. Releasing the TEST button returns the annunciator to its previous state.

6.0.3 Diagnostic Menu

While the X110 is in the configuration mode and the Main Menu is being displayed a "D" may be entered which will call up a special menu of diagnostic functions. Included in this is the ability to test, clear, or re-write the E^2PROM; run a "ripple" lamp test; or perform several other test functions.

6.1 Error Indication

Certain errors will cause the X110 controller to act directly on its lamp display to convey the fact of an error occurrence to the user.

6.1.1 EEPROM Checksum Error

Symptom: All display lamps "pulsate" at approximately a 3-second interval. The lamps remain on slightly less than one second. There is flashing in the background to active alarms.

Cause: If the X110 enters the RUN phase and calculates a checksum for the contents of the E^2PROM that is different from the checksum that is retained in the E^2PROM it considers this a catastrophic error. It is likely that the E^2PROM now holds incorrect information and that the parameters entered during the configuration mode have been corrupted. The X110 enters a state of continual lamp flashing in which all display lamps attached to a particular X110 Controller are flashed. This flashing can be stopped by cycling power OFF then ON or by a manual hardware rest; however, if the checksum condition persists so will the flashing display.

Corrective Action: The X110 should be placed into the configuration mode and the contents of the E^2PROM should be reviewed and corrected. If any parameter entry (a write to the E^2PROM) is made during configuration mode, the checksum for the E^2PROM will be regenerated and stored as the X110 exits the configuration mode.

CAUTION: If the X110 is to be "Write Protected" by means of SW1-5 that switch should remain "OFF" until the X110 has been returned to the Run Mode.

6.1.2 Communication Error (Visual Indication)

Symptom: All display lamps "pulsate" at approximately a 3-second interval. The lamps remain on slightly less than one second. This flashing is in the background to active alarms.

Cause: This is a warning that the X110 controlling the flashing lamps has detected an error in communications from the host and was not able to recover the transmitted data through retries, providing it has been equipped with a message validating protocol during configuration (i.e., ACK/NAK).

Corrective Action: Pressing the TEST button will clear the background lamp pulsation.

6.1.3 Communication Error (Protocol Response)

If the MASTER X110 detects a parity error in communications, it will normally issue a "NAK" response although this is not the case for all input devices (i.e., the Ronan X120). A "NAK" response during or immediately following a data message is a signal to the host device to RE-TRANSMIT the message. The host should conclude the current transmission with a Carriage Return (0D HEX) and re-transmit the entire message line.

The X110 will react to this transmission error depending on the value stored in RETRY ATTEMPTS during the configuration mode for comm parameters. The X110 expects this line to be retransmitted successfully before the RETRY count reaches zero or it will begin to present the visual error indication described in Section 6.1.2.

If the X110 is communicating with a Ronan X120 Multiplexer, it withholds the normal "ACK" response rather than returning a "NAK". The X120 will attempt to re-transmit up to three times if it does not receive proof through an "ACK" that the message line was received error-free. After three unsuccessful attempts, the visual error indication described in Section 6.1.2 is presented.

If there are three consecutive character parity errors, the visual error indication will be presented regardless.

6.1.4 Power On or Reset

Symptom: The X110 display lamps are active in a "ripple" test pattern (lamps are cycling, one at a time, on then off, left to right). THIS IS NORMAL BEHAVIOR.

Cause: The X110 has just been RESET while in the RUN mode. This could be a result of just being powered on, it was reset from the controller reset button, or the watchdog timer may have expired. The X110 assumes that it is not up-to-date regarding alarm status and notifies the user by continuing this test pattern until one of the following steps is taken.

Corrective Action: The "ripple" test pattern ceases when any of the following actions take place:

- The TEST button is pressed.
- A "Clear Alarms" (ESC 4) command is received.
- The X110 is placed in the Configuration Mode.
- A message from the host is directed specifically to this X110.

6.2 X110 Problem Report/Suggestion Form

User feedback is extremely helpful in refining products at Ronan and so it is that your comments, suggestions and any problem descriptions are avidly sought. Please, make copies of the form (on the next page) as needed and submit them to the address given at the bottom of the form.

RONAN

X110 PROBLEM REPORT/SUGGESTION FORM

No. _____

Submitted by (name): _____

Company: _____

Address: _____

City/State/Zip: _____

Phone: _____ **Date:** _____

Software Versions (from the EPROM labels):

LMP _____ **(U6)** **COM** _____ **(U40)**

Ronan Board ID: _____

Is there a board traveler?: (___) **Yes** _____ (___) **No** _____
(Please attach a label/tag to the board with the date, your initials and company name, if it is being returned)

NATURE OF THE PROBLEM: (___) **Software** (___) **Hardware** (___) **?**
or SUGGESTION: (___) **Suggestion**

_____

_____

_____

_____

_____

_____

(___) **Refer to attached material**

Complete and return to:
Ronan Engineering Company
P.O. Box 1275
21200 Oxnard Street, Woodland Hills, CA 91367, USA
Attn: Customer Service Manager

SECTION 7 - X110 PARTS LISTS AND SCHEMATICS

7.0 Parts Lists

Note: The parts lists in this manual, while representative of the actual lists, are subject to engineering control or update: product revisions may occur without changes to this publication.

7.0.1 X110 Controller

Ronan Engineering Company
Parts List

Controller Board
X110-1000[ ] – [ ]
- [ ] — Option 1, 2, 3, or 4 (if required)
- [ ] — GP or HS (see item 69)

ITEM	QTY	IDENT.	PART NUMBER	DESCRIPTION	MFG.
1	1	PCB	X110-1000D	P.C. Board	Ronan
2	2	U1,U30	DILB40P-108	IC, 40 Pin Socket	Burndy
3	3	U6,U39,U40	DILB28P-108	IC, 28 Pin Socket	Burndy
4	2	U1,U30	80C31	Microprocessor	Any Intel, AMD, Siemans, Signetics, OKI, Matra-Harris, Fujitsu
5	1	U7	TC5565-15	SRAM (8Kx8≤150ns)	Any Motorola MCM6064, Toshiba TC5565, Hitachi HM6264LP, Matra-Harris HM3 2064
6	1	U39	2864A or B	EEPROM	Xicor
7	1	U6	27C256-2	32KEPROM	Any GI, TI, ATMEL

Note: this part is programmed by Ronan to: LMPR_*_U6
X110 Date
Program the EPROM using the X110 hex file, LMPR_*_HEX, and then attach the printed identification label to the EPROM face. An asterisk (*) represents the current revision level.

8	1	U40	27C256-2	32KEPROM	Any GI, TI, ATMEL

Note: this part is programmed by Ronan to: COMR_*_U40
X110 Date
Program the EPROM using the X110 hex file, COMR_*_HEX, and then attach the printed identification label to the EPROM face. An asterisk (*) represents the current revision level.

9	13	U8-U20	UCN5800A	Latched Drivers	Sprague
10	1	U35	DS1232	PwrMonit/WD Timer	Dallas
11	1	U33	ICL232CPE	RS232	Intersil
12	1	U28	74HC279P	Quad S-R Latch	SGS, Toshiba
13	2	U2,U31	74HCT573	Octal D Latch	Signetics
14	1	U21	74HCT574	Octal F/F	Signetics
15	2	U27,U37	74HC00	2-Input Nand Gate	Signetics
16	2	U5,U36	74HCT240	Buffer/Line Driver	Signetics

17	1	U3	74HCT688	8 Bit Comparator	Signetics
18	1	U4	74HCT138	3 to 8 Decoder	Signetics
19	1	U22	SN75174	RS422/485 Driver	TI
20	1	U23	SN75175	RS422/485 Receiver	TI
21	2	U29,U38	74HCT257	Quad 2-Inptu Mux	Signetics
22	1	U26	SN75176	RS422/485 Transceiver	TI
23	1	U24	74HCT245	Bus Transceiver	Signetics
24	2	RP2,RP3	4308R-102-560	Isl. Res. Sip 56 Ohm	Bourns
25	2	RP1,RP4	4308R-101-103	Res. Sip 10K	Bourns
26	2	Y1, Y2	11.059mhz HC-49	11.0592mhz Xtal	Fox
27	2	R10, R11	RC07GF121J	Resistor 120 Ohm	A.B.
28	2	R3, R21	RC07GF102J	Resistor 1K Ohm	A.B.
29	2	R6, R7	RC07GF332J	Resistor 3.3K Ohm	A.B.
30	2	R17, R18	RC07GF392J	Resistor 3.9K Ohm	A.B.
31	9	R14,R15,R22 -24,R26-32	RC07GF103J	Resistor 10K Ohm	A.B.
32	2	C13, C42	330A500C05	Cap 33pf Cer. Conformal Axial Temp. Stable 5%	Ronan
33	2	C14, C43	220A500C05	Cap 22pf Cer. Conformal Axial Temp. Stable 5%	Ronan
34	18	C3-5,C9-12, C15-17,C19, C25,C26,C29 -31,C33, C38	223A500C20	Cap .022 ufd	Ronan
35	1	C22	334R350T20	Cap .33 ufd	Ronan
36	8	C2,C7,C8, C23,C32,C44 C45, C47	104R500C20	Cap .1 ufd	Ronan
37	5	C1,C20,C24, C41,C46	105A350T20	Cap 1 ufd	Ronan
38	2	C6,C28	685A350T10	Cap 6.8 ufd	Ronan
39	4	C34-37	226A100T10	Cap 22 ufd Tant	Ronan
40	1	C21	336A160E28	Cap 33 ufd Elect.	Ronan
41	1	C18	107A400E28	Cap 100 ufd Elect.	Ronan
42	1	VR1	M78T05CT	24 to 5V, Regulator	Motorola
43	1	F1	MDA10	10A Fuse	
44	3	V1-3	V275LA20A	Varistor	
45	1	J4	13490.6/SLA90	24 Pole 90° Hd	Weidmuller
46	1	(Mate to J4)	13144.6/BLA	24 Pole Socket	Weidmuller
47	1	(Attach. Mate)	13275.6	Strain Relief	Weidmuller
48	1	P5	FC064-031-2	64 Pin VME Conn.	T&B
49	1	J1	745068-7	25 Pin D-Connector	Amp
50	2	J2, J3	745067-5	15 Pin D-Connector	Amp
51	6	J1-3	4-40x5/16	F1 Hd Slt Screw and Split-Washers	Ronan
52	6	CR5-8,CR15, CR16	1N4148	Diode	Ronan
53	5	CR19, CR22, CR27-29	1N6385 or 1N6384 or MPTE-12C	Diode (Trans.Sup)	GenSemi-Motorola

			or MPTE-15C		
54	7	CR20, CR21, CR33-3	P6KE7.5A	Diode (Trans.Sup)	
55	1	CR39	1N270	Diode	
56	15	W1,W2,W7, W10,W11, W14-17, W19,W28	8-910-11	2 Pin Single Strip	HDR
57	10	W8,W9,W18, W20-22, W26-27, W29, W30	10-910-11	3 Pin Single Strip	HDR
58	2	(W3,4), (W5,6)	8-910-11	8 Pin Single Strip	HDR
59	3	W23,W25	Jumper 18GA		
60	1	SW1	SL1008	8-Pos. Dip Switch	
61	1	SW2	EP11D1CBE	Momentary Switch	CK
62	1	VR1	6070B	Heat Sink	
63	1	VR1	6071B	Heat Sink	
64	2	F1	3529	Fuse Clip	
65	1	VR1	4.40x3/8"	Screw	
66	1	VR1	4.40	Nut	
67	1	VR1	4.40	Washer	
68	16	W4-(Mid AB) W5-(Mid AB) W8-232), W9-(DTR), W10,W11, W15,W17, W18-(232), W20-(232), W21-(232), W22-(A), W26-(A), W27-(B), W29-(B), W30-(B)	531220-2	Berg Jumpers	
69	If assembly is X110-1000(GP) use the following:				
	3	K2, K4, K6	T82S11D114-24V	PCB Relay	Pottr-B.
	If assembly is X110-1000(HS) use the following:				
	3	K1,K3,K5	50GBON-1-A-700	PCB Relay (Herm. Seal)	Elec. Spec

X110-1000 Optional Parts

Option 1 - RS232 Current Loop

ITEM	QTY	IDENT.	PART NUMBER	DESCRIPTION	MFG.
1	1	U34	ULN2003A	HV, Current D.A.	
2	2	U25, U32	4N37	Opto Isolator	Motorola
3	2	R4, R5	RC07GF105J	Resistor 1M ohm	A.B.
4	2	R8, R9	RC07GF470J	Resistor 47 ohm	A.B.
5	1	R16	RC07GF471J	Resistor 470 ohm	A.B.
6	2	R28, R29	RC07GF432J	Resistor 4.3K ohm	A.B.
7	2	CR23, CR24	1N4148	Diode	

Option 2 - Zener Line Protection

ITEM	QTY	IDENT.	PART NUMBER	DESCRIPTION	MFG.
1	19	CR1-4, CR9-14, CR20, CR21, CR25, CR26, CR30, CR31, CR33-36	BZX79-C39 (1N5252)	Diode	

Option 3 - UnReg 24VDC Power Input

ITEM	QTY	IDENT.	PART NUMBER	DESCRIPTION	MFG.
1	1	R1	UT10A-120 ohm	Resistor 120 ohm 10W	Reidon
2	1	R2	UT7A-30 ohm	Resistor 30 ohm 7W	Reidon
3	1	W24	Wire Jmpr 18 Ga.		
4	0	W23, W25	REMOVE Wire Jmprs		

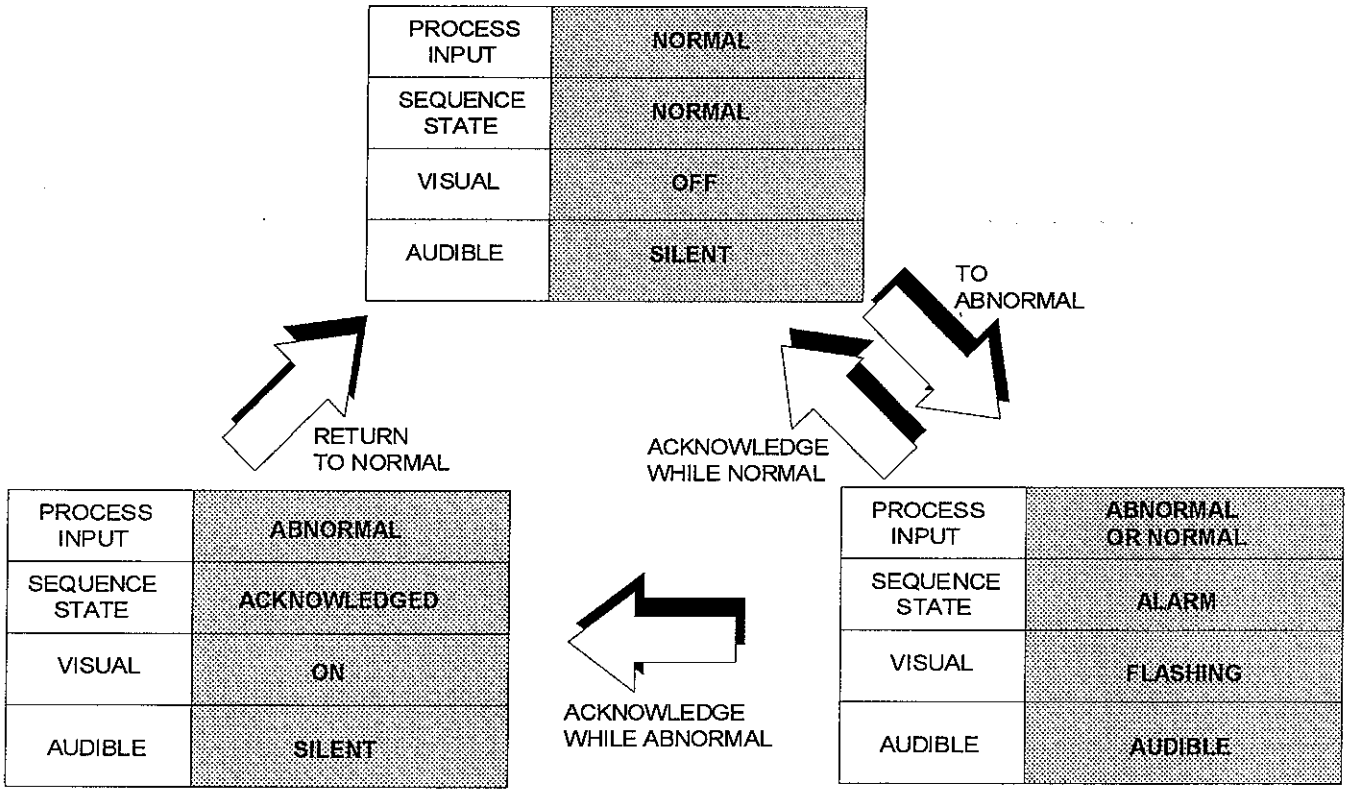
7.1 Drawings

See drawings under Tab 14.

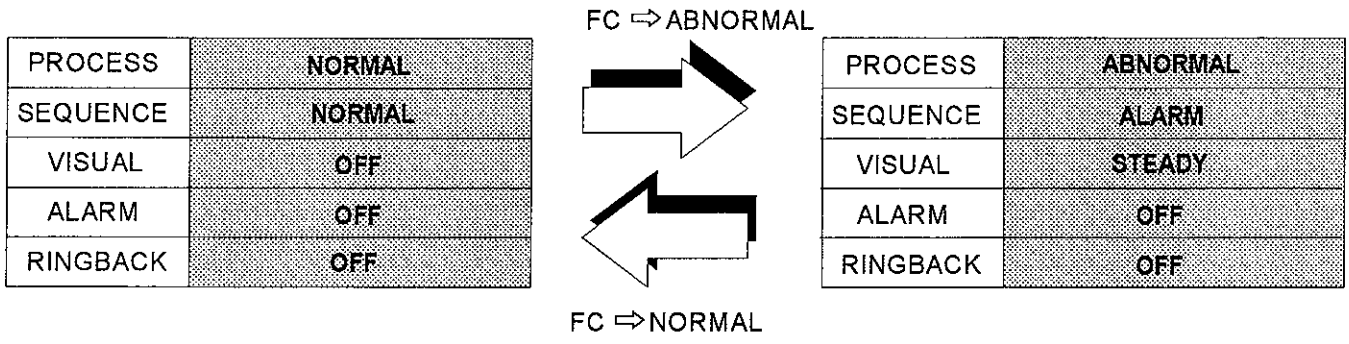
SECTION 8 - ALARM SEQUENCES

8.0 Sequence Flow Diagrams

8.0.1 A - Automatic Reset

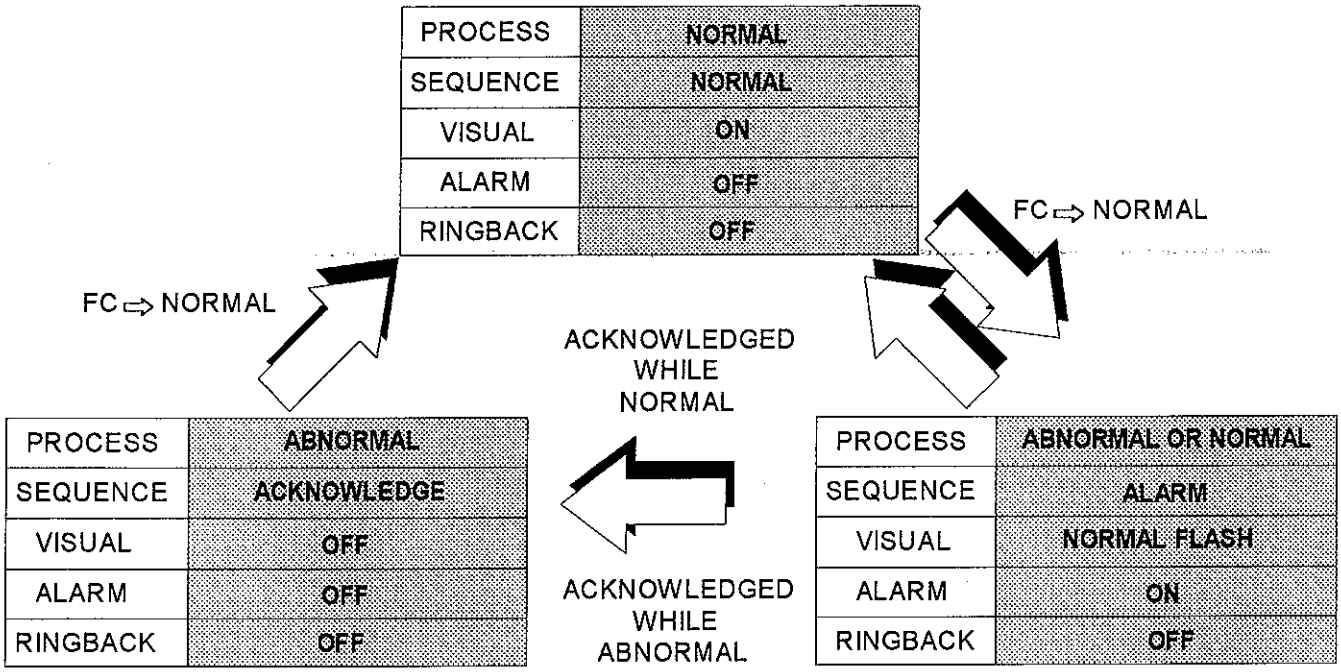


8.0.2 AAWSM - Automatic Acknowledge with Silence Manual



8.0.3 APRM - A Prime

This sequence is similar to "A" except that the display lamps are normally ON and are turned OFF when abnormal. The TEST button will also turn the lamps OFF.



8.0.4 A/4 - Automatic Reset without Lock-in

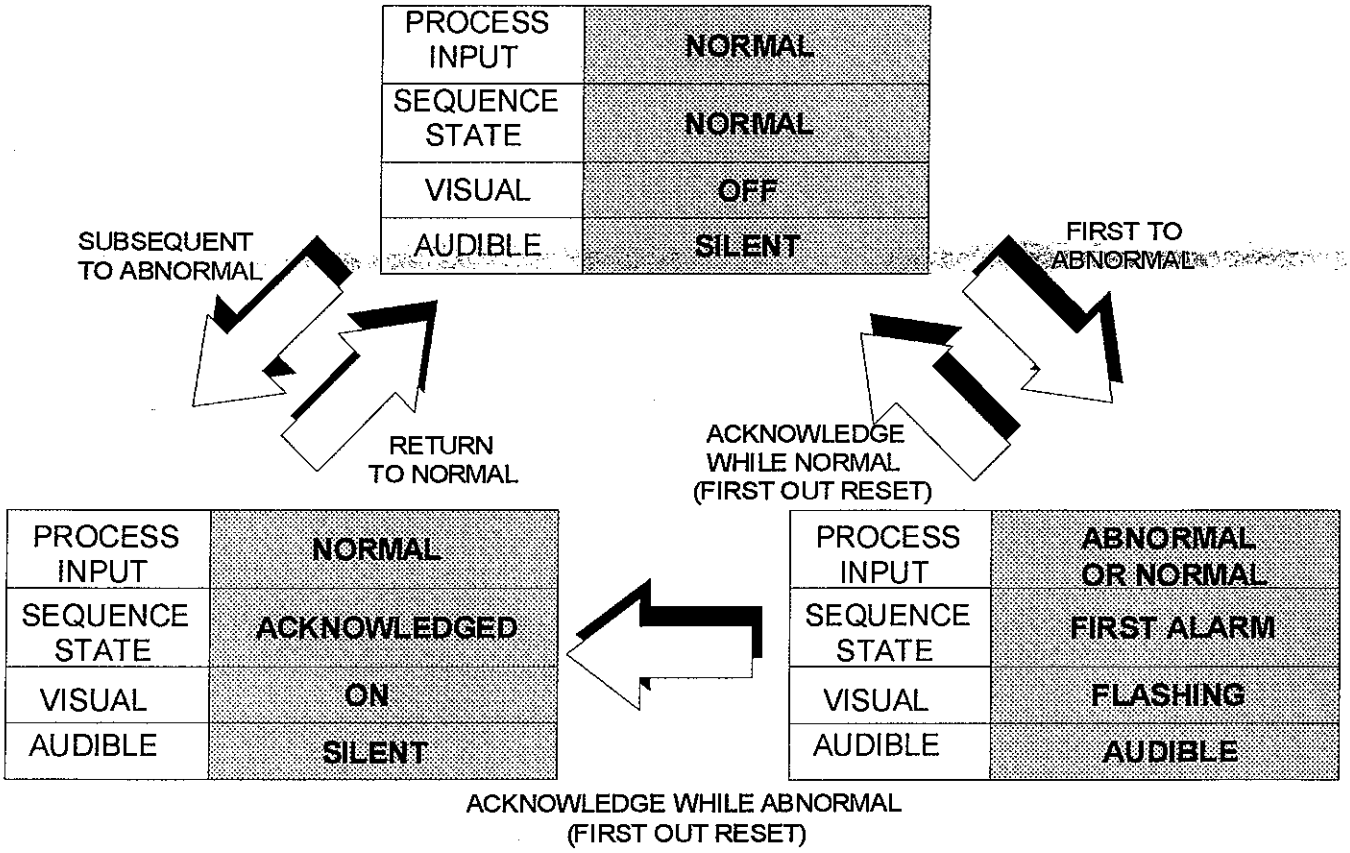
This sequence is similar to "A" with one difference, a momentary alarm returns to the NORMAL sequence state without waiting on the ACKNOWLEDGE button.

8.0.5 A/5, 6 - No Flashing, No Audible

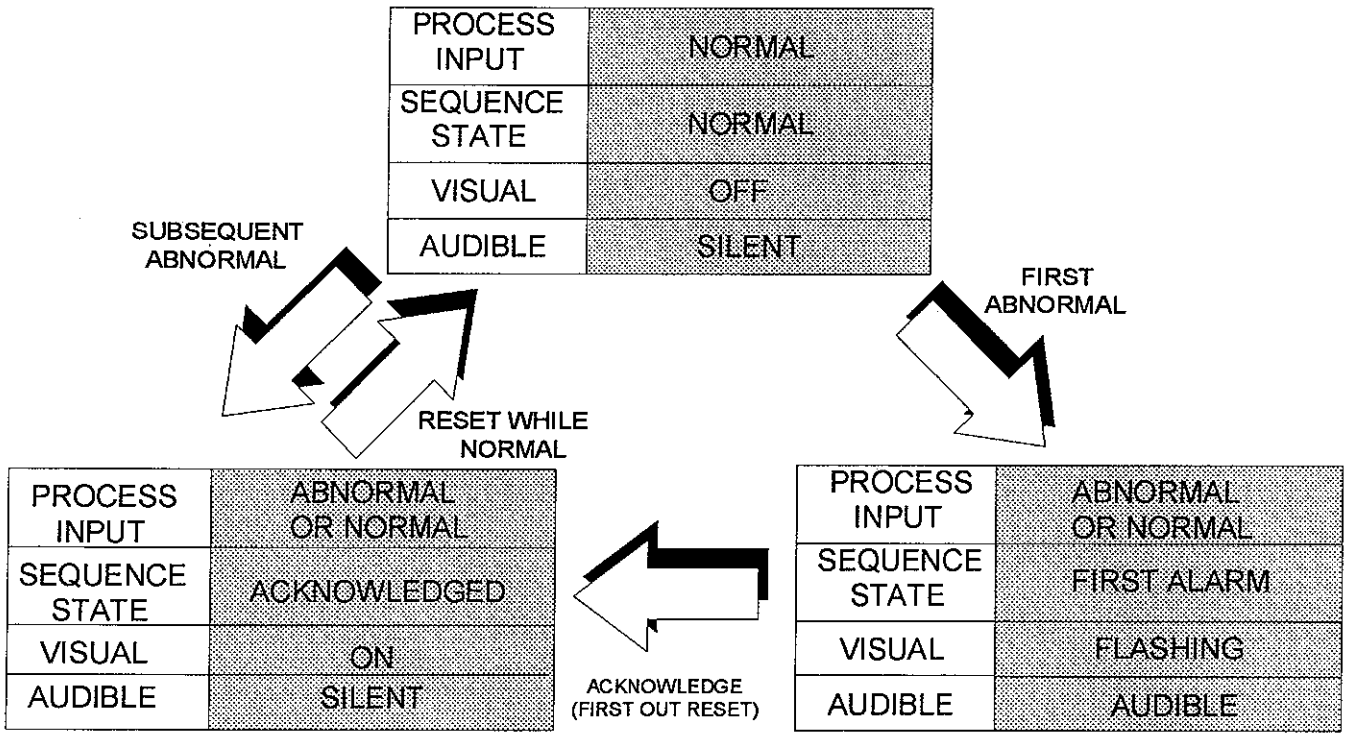
This sequence is similar to "A" except that there is no flashing. The display lamps simply turn "ON" for alarm.

8.0.6 F1A - First Out with Automatic Reset

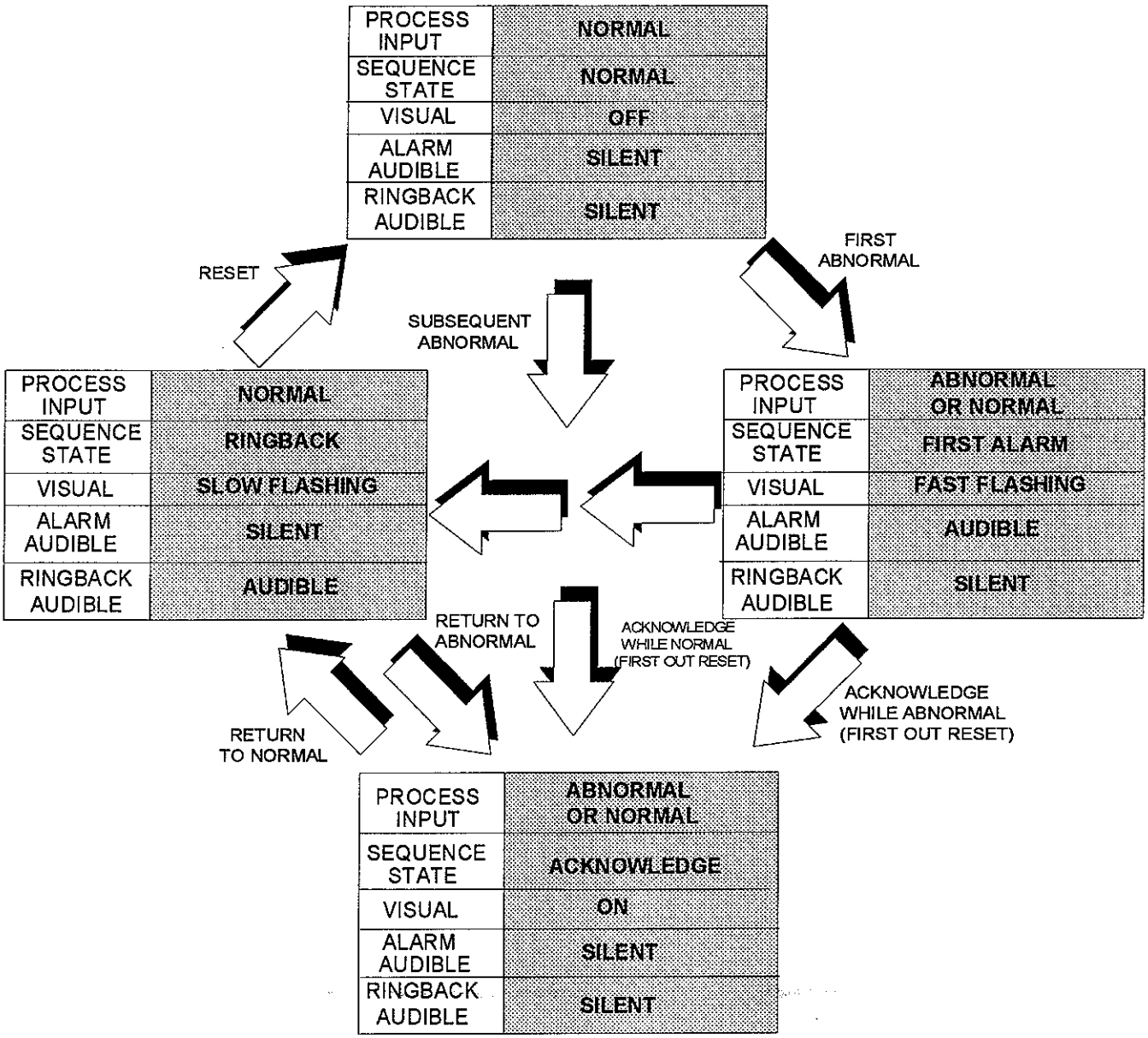
This is similar to the "A" sequence except that only the First Alarm will flash. Subsequent alarms simply display as steady ON.



8.0.7 F1M

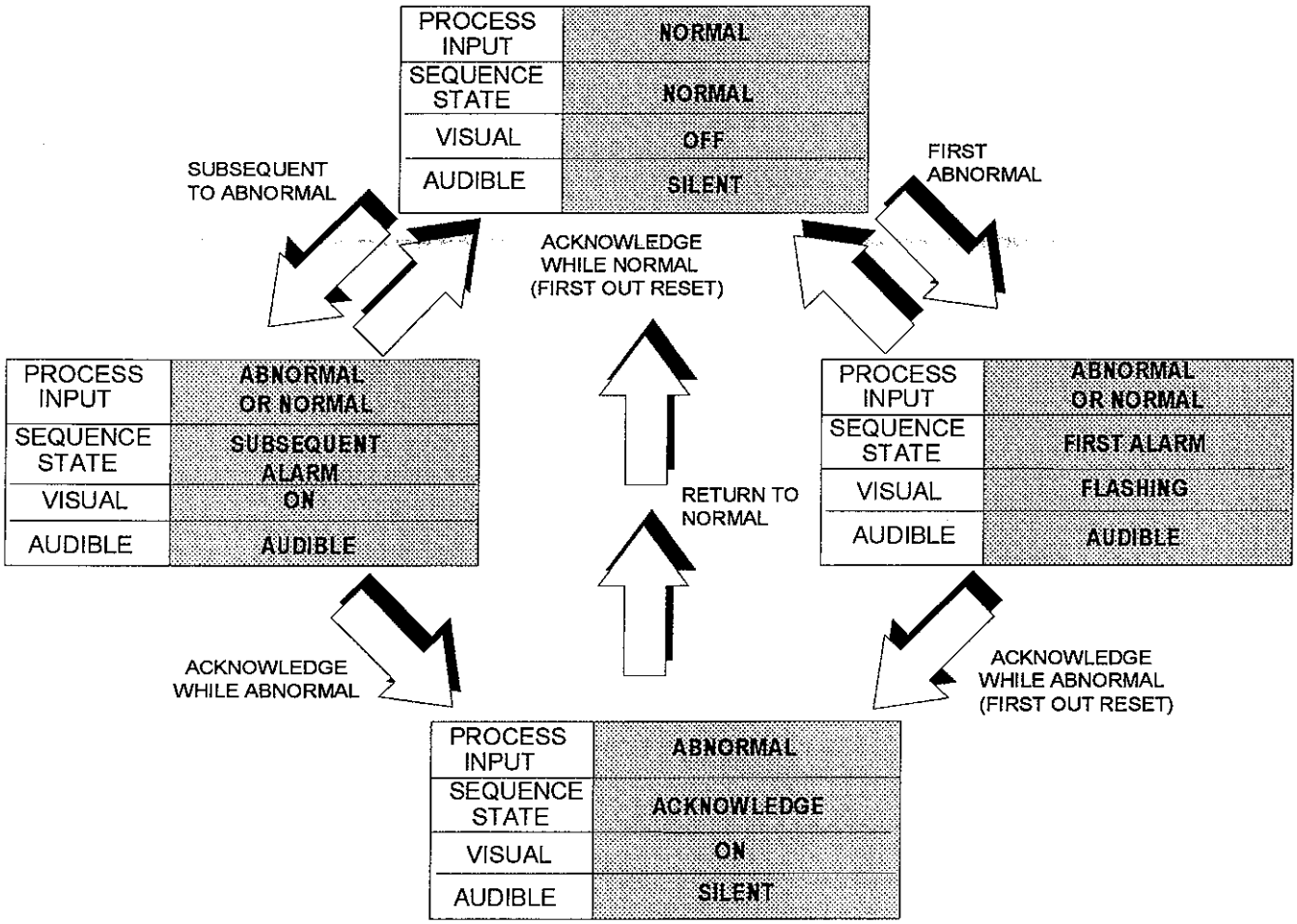

PROCESS INPUT
NORMAL
SEQUENCE STATE
NORMAL
VISUAL
OFF
AUDIBLE
SILENT
SUBSEQUENT ABNORMAL
FIRST ABNORMAL
RESET WHILE NORMAL
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
ACKNOWLEDGED
VISUAL
ON
AUDIBLE
SILENT
ACKNOWLEDGE (FIRST OUT RESET)
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
FIRST ALARM
VISUAL
FLASHING
AUDIBLE
AUDIBLE

8.0.8 F1R

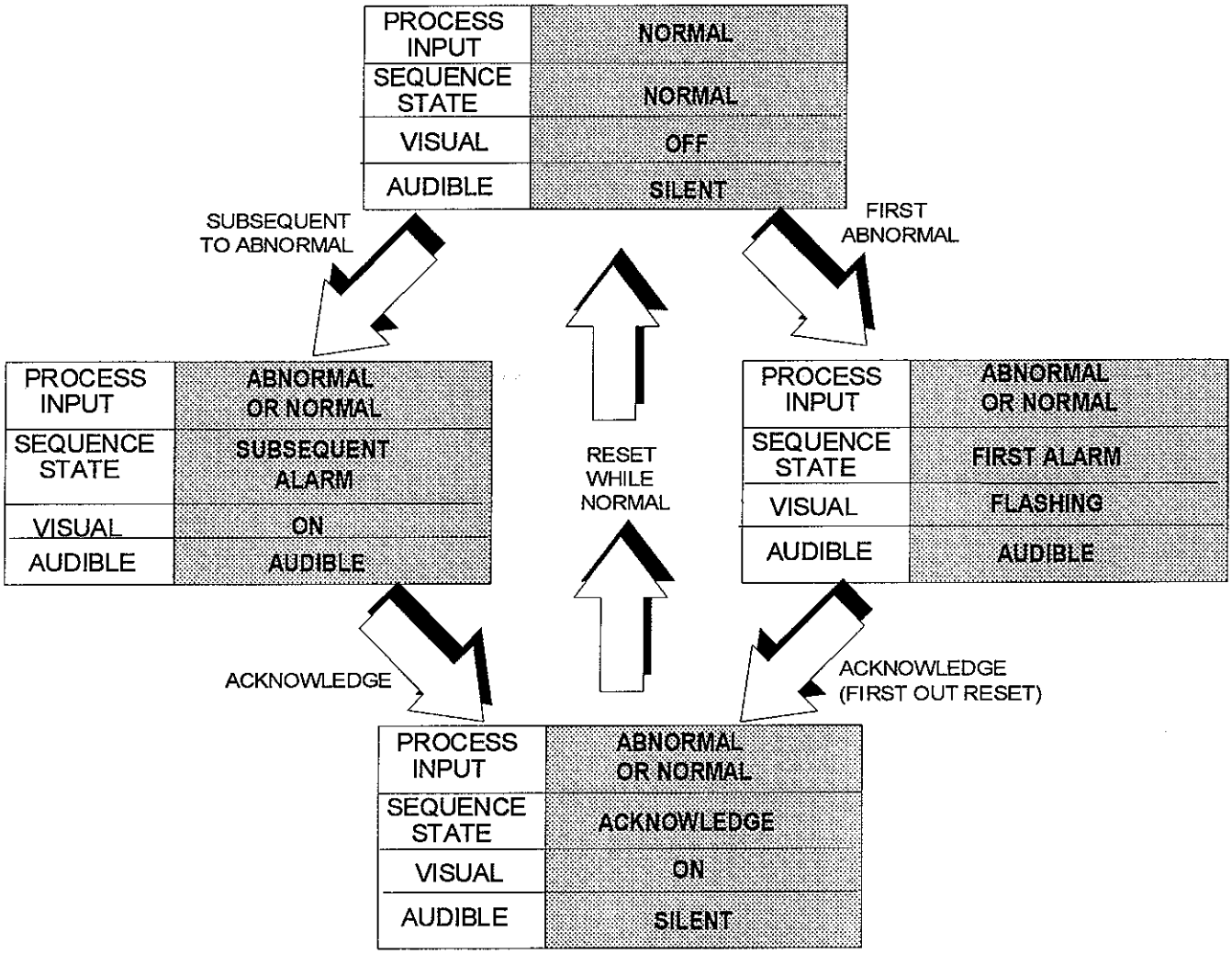

PROCESS INPUT
NORMAL
SEQUENCE STATE
NORMAL
VISUAL
OFF
ALARM AUDIBLE
SILENT
RINGBACK AUDIBLE
SILENT
RESET
FIRST ABNORMAL
SUBSEQUENT ABNORMAL
PROCESS INPUT
NORMAL
SEQUENCE STATE
RINGBACK
VISUAL
SLOW FLASHING
ALARM AUDIBLE
SILENT
RINGBACK AUDIBLE
AUDIBLE
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
FIRST ALARM
VISUAL
FAST FLASHING
ALARM AUDIBLE
AUDIBLE
RINGBACK AUDIBLE
SILENT
RETURN TO ABNORMAL
ACKNOWLEDGE WHILE NORMAL (FIRST OUT RESET)
RETURN TO NORMAL
ACKNOWLEDGE WHILE ABNORMAL (FIRST OUT RESET)
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
ACKNOWLEDGE
VISUAL
ON
ALARM AUDIBLE
SILENT
RINGBACK AUDIBLE
SILENT

8.0.9 F2A

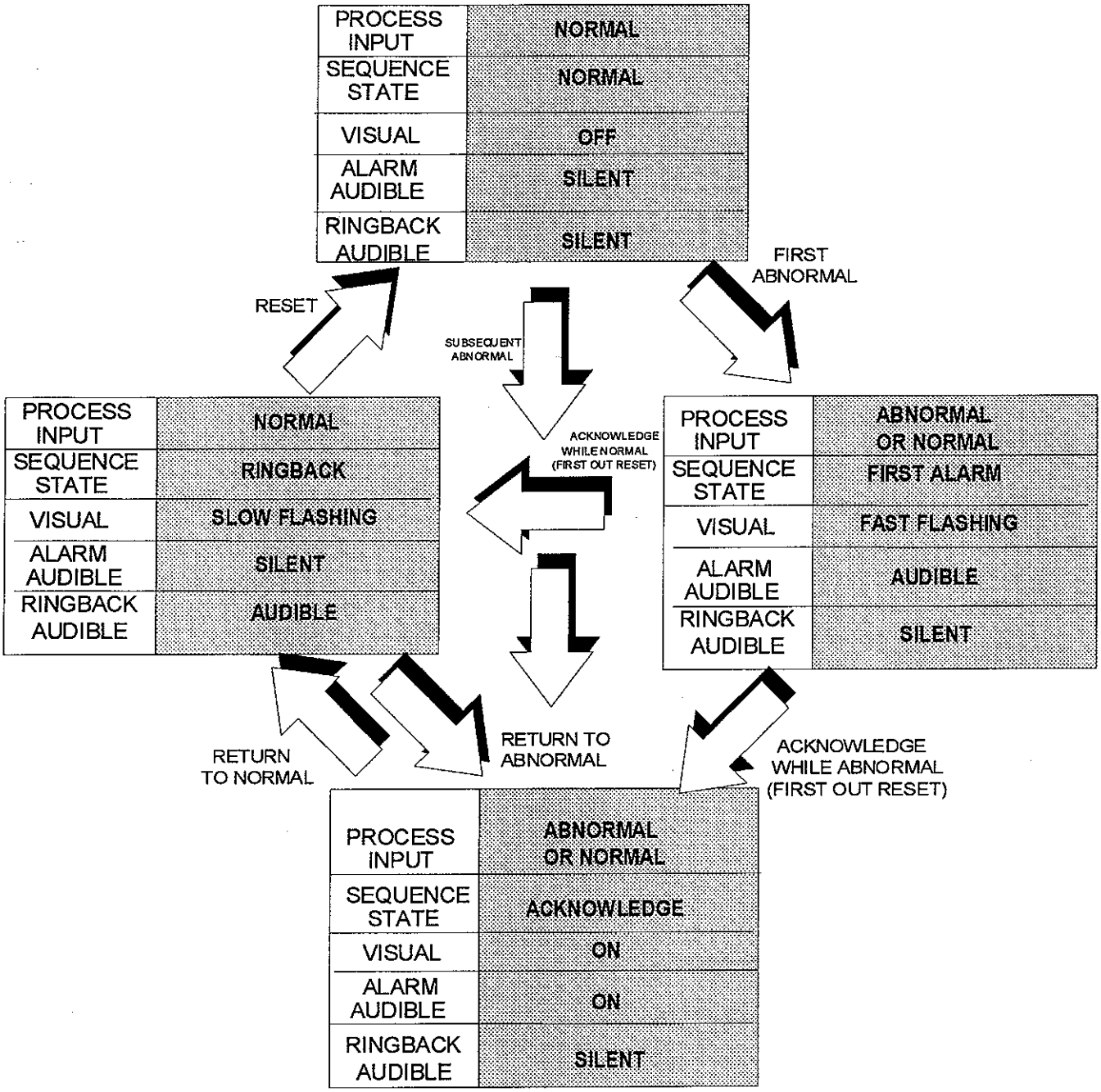
This is similar to the "F1A" sequence but subsequent alarms will activate the audible device.



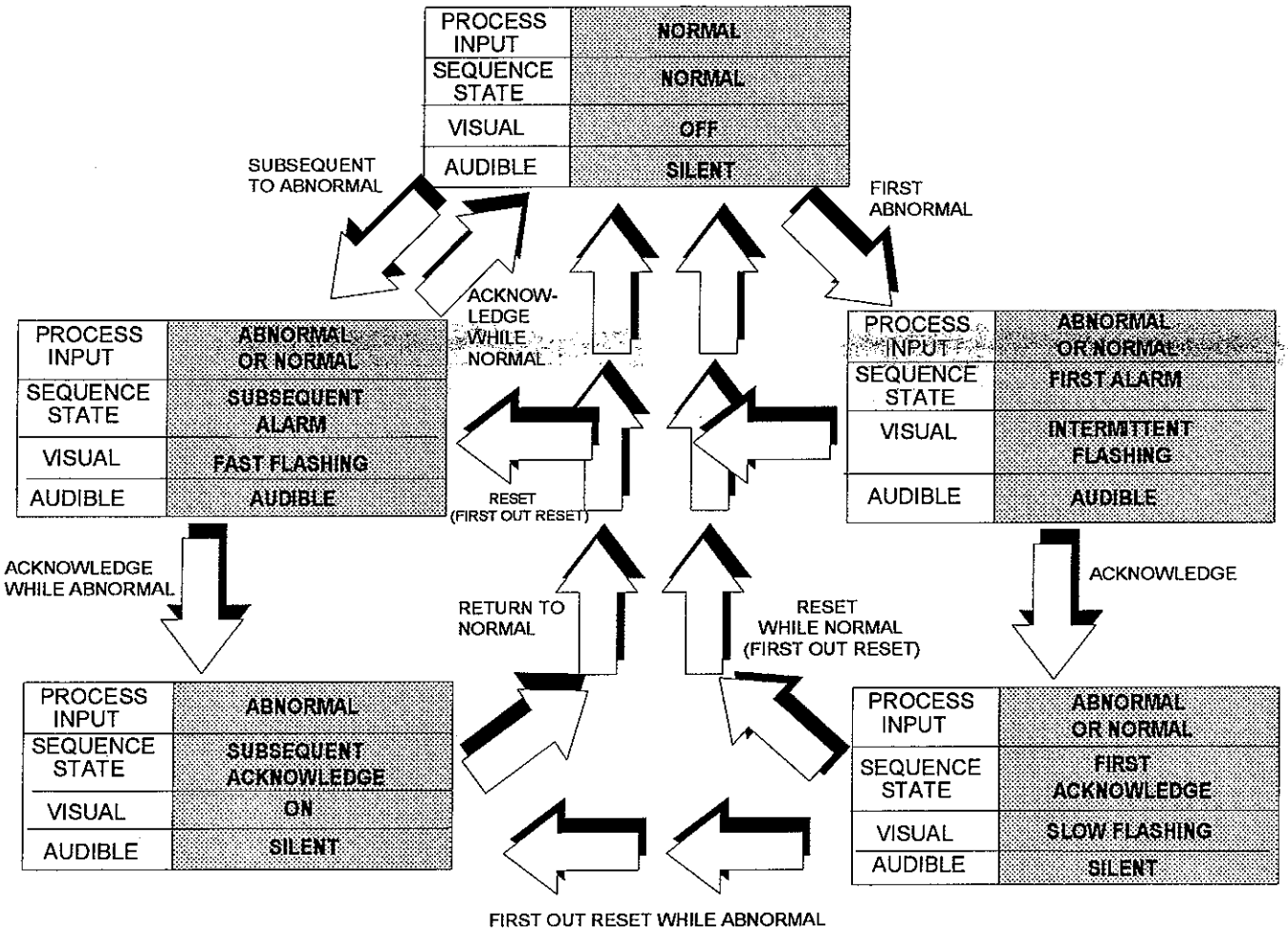
8.0.10 F2M


PROCESS INPUT
NORMAL
SEQUENCE STATE
NORMAL
VISUAL
OFF
AUDIBLE
SILENT
SUBSEQUENT TO ABNORMAL
FIRST ABNORMAL
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
SUBSEQUENT ALARM
VISUAL
ON
AUDIBLE
AUDIBLE
RESET WHILE NORMAL
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
FIRST ALARM
VISUAL
FLASHING
AUDIBLE
AUDIBLE
ACKNOWLEDGE
ACKNOWLEDGE (FIRST OUT RESET)
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
ACKNOWLEDGE
VISUAL
ON
AUDIBLE
SILENT

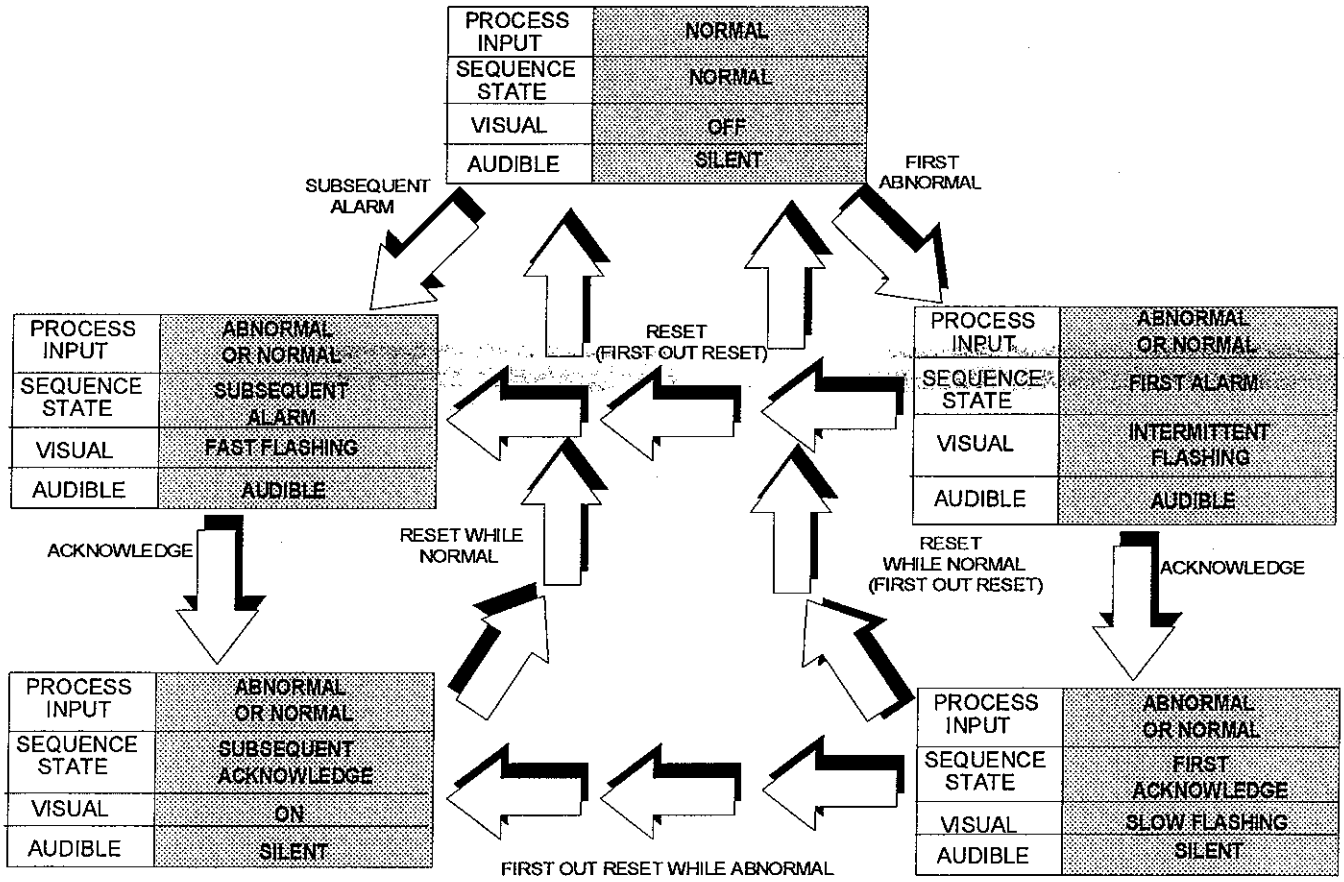
8.0.11 F2R


PROCESS INPUT
NORMAL
SEQUENCE STATE
NORMAL
VISUAL
OFF
ALARM AUDIBLE
SILENT
RINGBACK AUDIBLE
SILENT
FIRST ABNORMAL
RESET
SUBSEQUENT ABNORMAL
ACKNOWLEDGE WHILE NORMAL (FIRST OUT RESET)
PROCESS INPUT
NORMAL
SEQUENCE STATE
RINGBACK
VISUAL
SLOW FLASHING
ALARM AUDIBLE
SILENT
RINGBACK AUDIBLE
AUDIBLE
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
FIRST ALARM
VISUAL
FAST FLASHING
ALARM AUDIBLE
AUDIBLE
RINGBACK AUDIBLE
SILENT
RETURN TO NORMAL
RETURN TO ABNORMAL
ACKNOWLEDGE WHILE ABNORMAL (FIRST OUT RESET)
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
ACKNOWLEDGE
VISUAL
ON
ALARM AUDIBLE
ON
RINGBACK AUDIBLE
SILENT

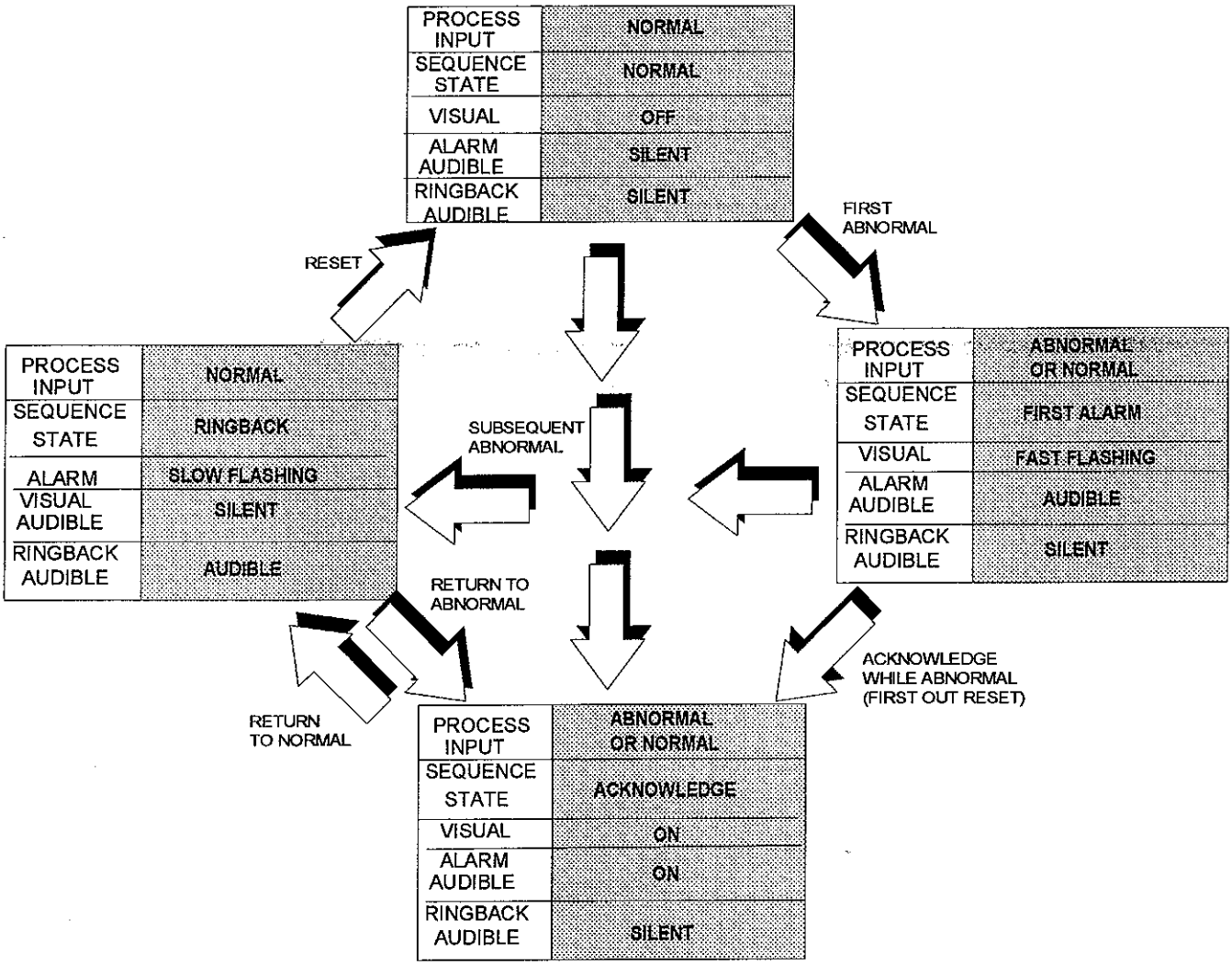
8.0.12 F3A


PROCESS INPUT
NORMAL
SEQUENCE STATE
NORMAL
VISUAL
OFF
AUDIBLE
SILENT
SUBSEQUENT TO ABNORMAL
FIRST ABNORMAL
ACKNOW-LEDGE WHILE NORMAL
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
SUBSEQUENT ALARM
VISUAL
FAST FLASHING
AUDIBLE
AUDIBLE
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
FIRST ALARM
VISUAL
INTERMITTENT FLASHING
AUDIBLE
AUDIBLE
RESET (FIRST OUT RESET)
ACKNOWLEDGE WHILE ABNORMAL
ACKNOWLEDGE
RETURN TO NORMAL
RESET WHILE NORMAL (FIRST OUT RESET)
PROCESS INPUT
ABNORMAL
SEQUENCE STATE
SUBSEQUENT ACKNOWLEDGE
VISUAL
ON
AUDIBLE
SILENT
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
FIRST ACKNOWLEDGE
VISUAL
SLOW FLASHING
AUDIBLE
SILENT
FIRST OUT RESET WHILE ABNORMAL

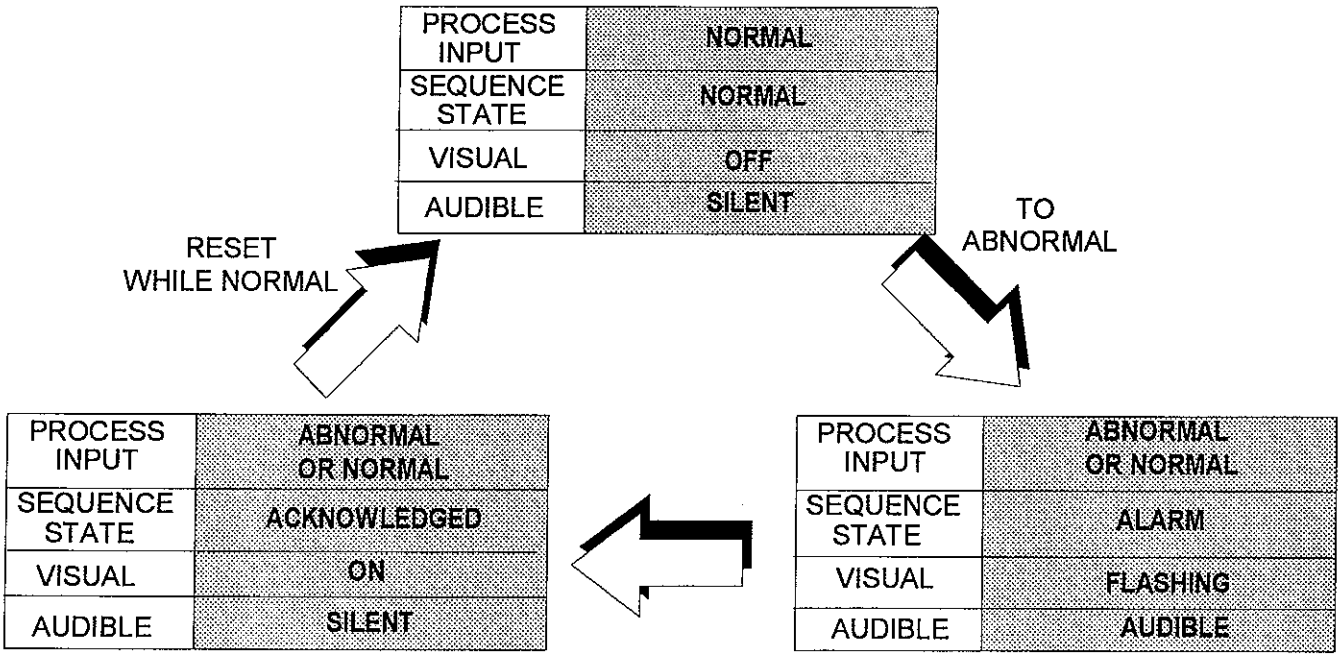
8.0.13 F3M


PROCESS INPUT
NORMAL
SEQUENCE STATE
NORMAL
VISUAL
OFF
AUDIBLE
SILENT
SUBSEQUENT ALARM
FIRST ABNORMAL
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
SUBSEQUENT ALARM
VISUAL
FAST FLASHING
AUDIBLE
AUDIBLE
RESET (FIRST OUT RESET)
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
FIRST ALARM
VISUAL
INTERMITTENT FLASHING
AUDIBLE
AUDIBLE
ACKNOWLEDGE
RESET WHILE NORMAL
RESET WHILE NORMAL (FIRST OUT RESET)
ACKNOWLEDGE
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
SUBSEQUENT ACKNOWLEDGE
VISUAL
ON
AUDIBLE
SILENT
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
FIRST ACKNOWLEDGE
VISUAL
SLOW FLASHING
AUDIBLE
SILENT
FIRST OUT RESET WHILE ABNORMAL

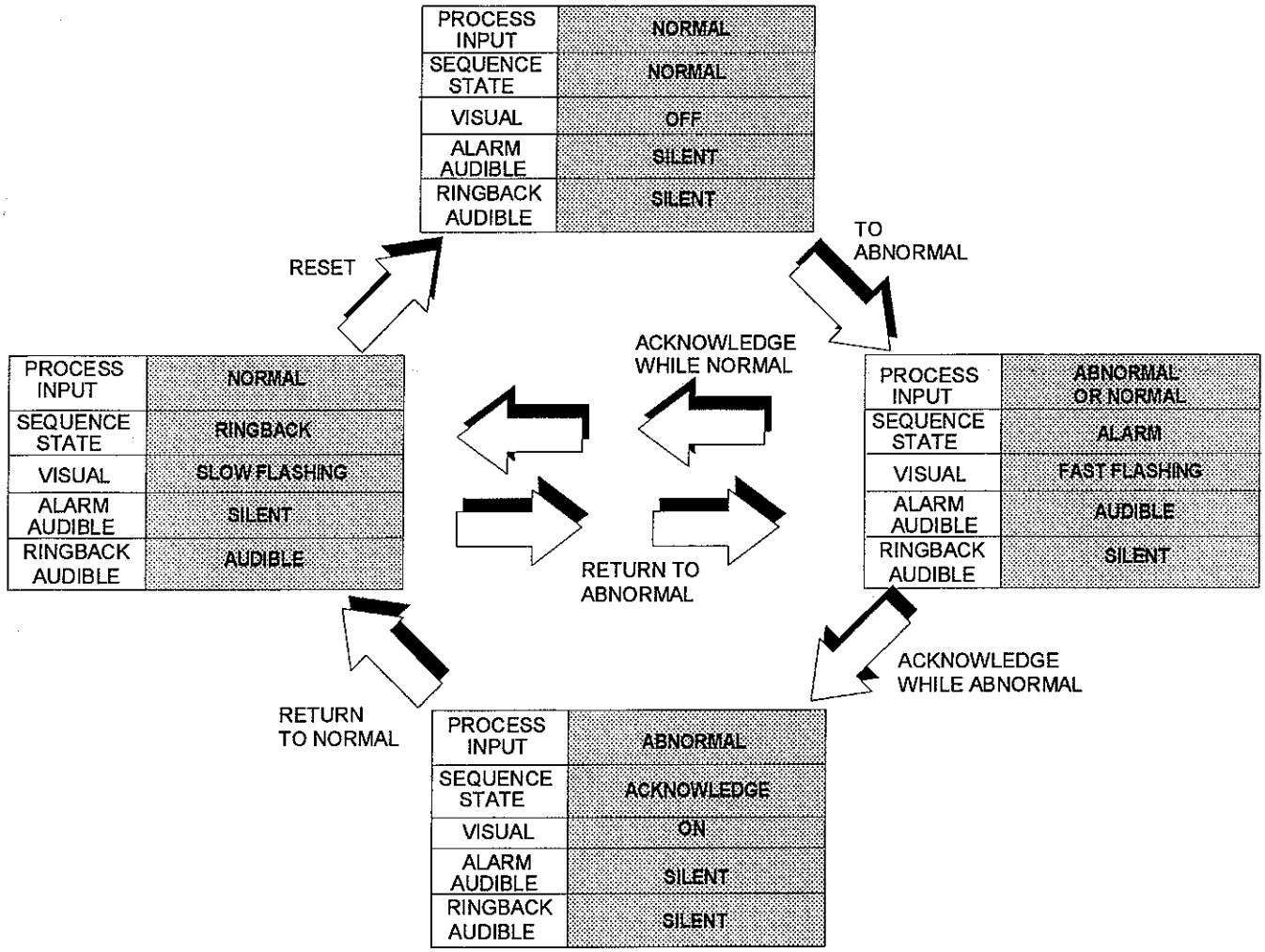
8.0.14 F3R


PROCESS INPUT
NORMAL
SEQUENCE STATE
NORMAL
VISUAL
OFF
ALARM AUDIBLE
SILENT
RINGBACK AUDIBLE
SILENT
FIRST ABNORMAL
RESET
PROCESS INPUT
NORMAL
SEQUENCE STATE
RINGBACK
ALARM VISUAL AUDIBLE
SLOW FLASHING
SILENT
RINGBACK AUDIBLE
AUDIBLE
SUBSEQUENT ABNORMAL
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
FIRST ALARM
VISUAL
FAST FLASHING
ALARM AUDIBLE
AUDIBLE
RINGBACK AUDIBLE
SILENT
RETURN TO ABNORMAL
ACKNOWLEDGE WHILE ABNORMAL (FIRST OUT RESET)
RETURN TO NORMAL
PROCESS INPUT
ABNORMAL OR NORMAL
SEQUENCE STATE
ACKNOWLEDGE
VISUAL
ON
ALARM AUDIBLE
ON
RINGBACK AUDIBLE
SILENT

8.0.15 M - Manual Reset

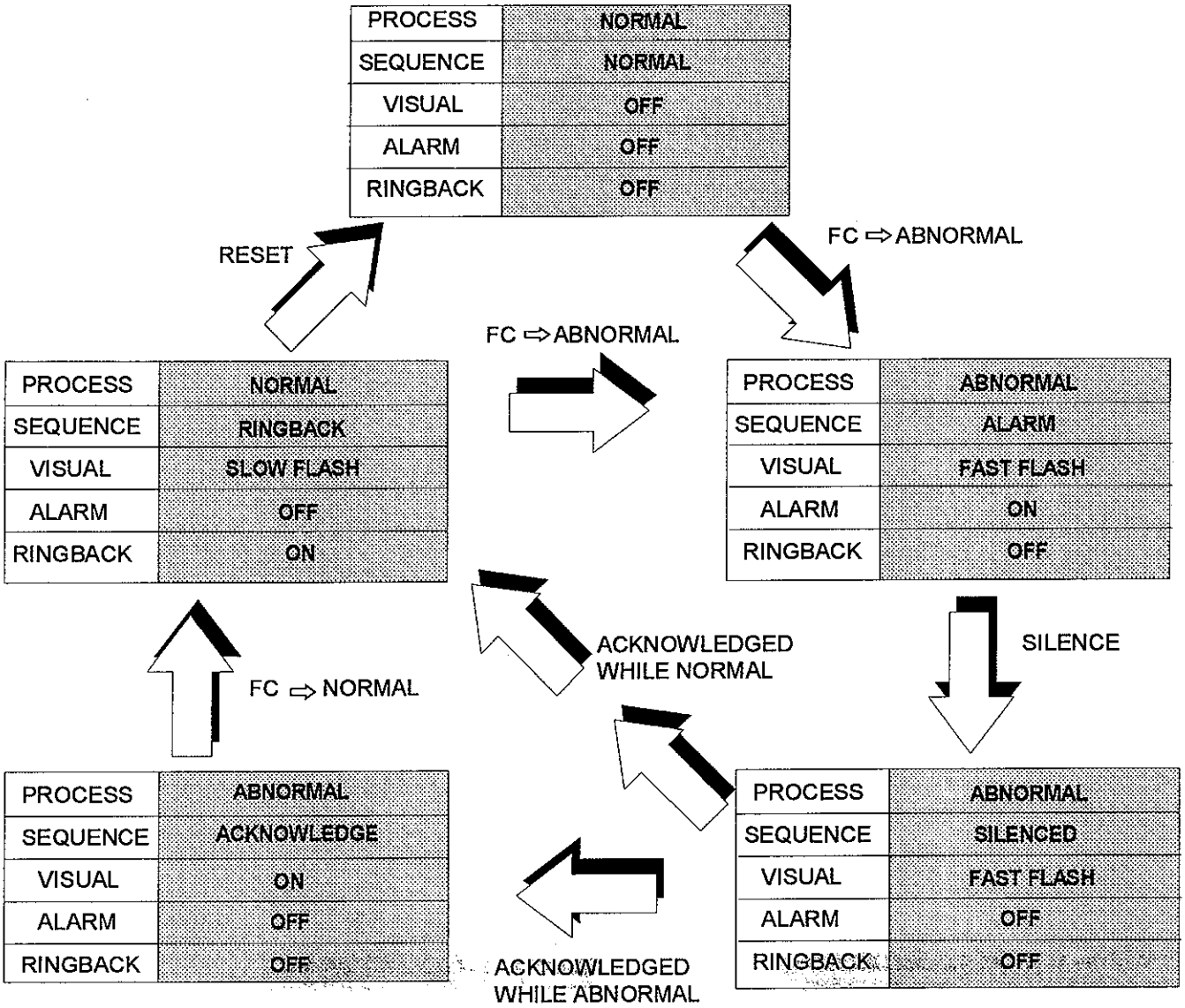


8.0.16 R - Ringback



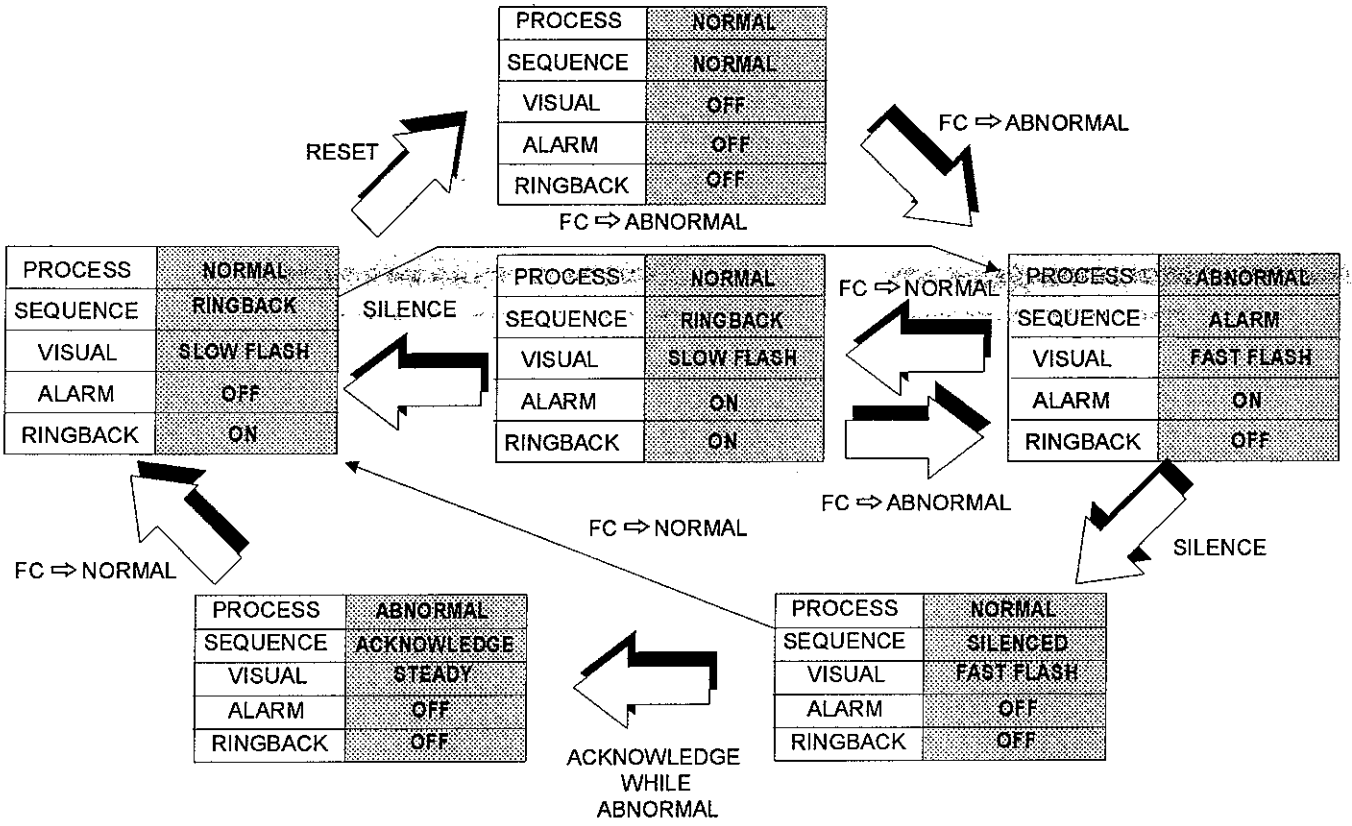
8.0.17 RDSH - Ringback with Silence Stage

This is similar to the "R" sequence, but the Silence Button is an integral component of the sequence.



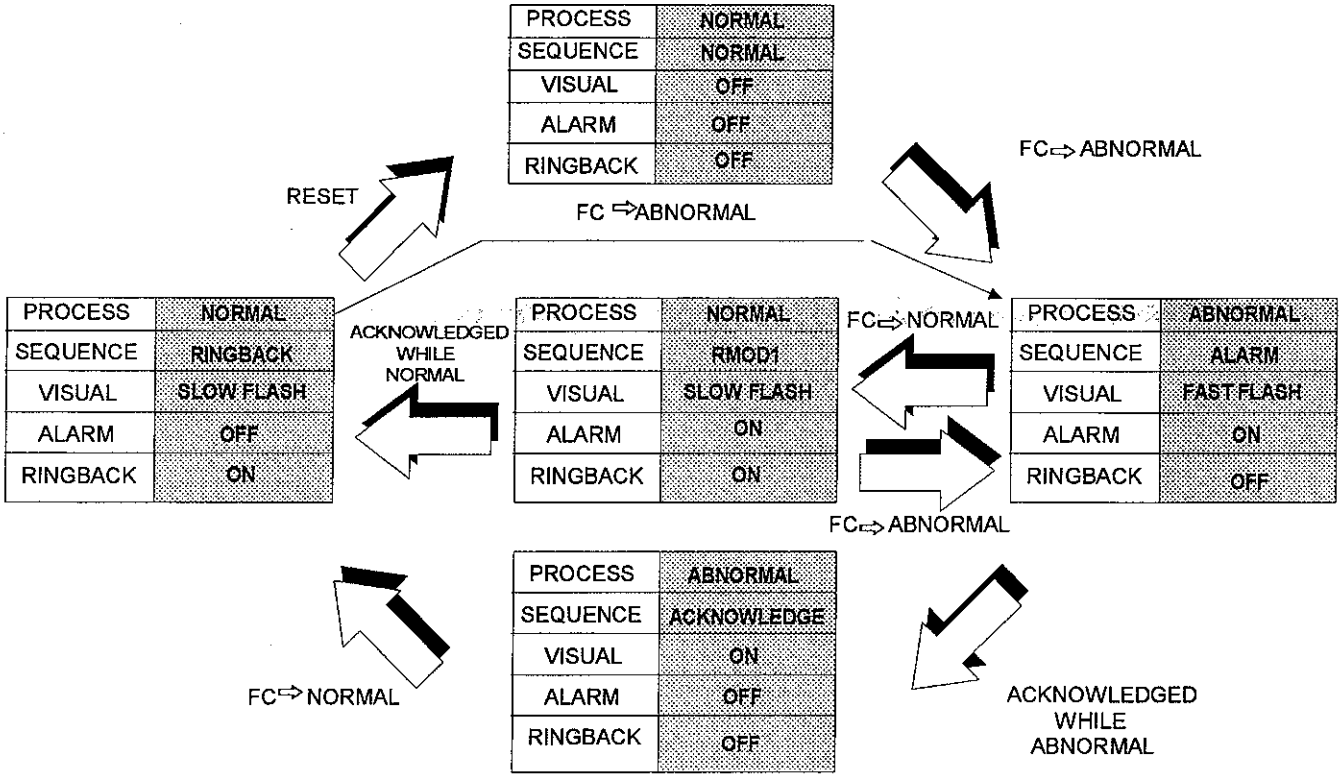
8.0.18 RDSMD1

This is similar to the "RDSH" sequence in that the Silence Button is an integral component of the sequence but this also allows the Slow-Flash state to be entered if the alarm input returns to normal.



8.0.19 RMOD1 - Modified Ringback

This is similar to the "R" sequence except that a Slow-Flash state can be entered automatically without an Acknowledge Button if the Alarm input returns to Normal.



8.0.20 RFL

This sequence is identical to AAWSM. The difference occurs when multiple points are assigned per window. The first alarm received causes the light to stay steady on and any subsequent alarms to that window will cause the light to blink off for half a second and then turn the light steady on.

8.0.21 SP2

SP2 is identical to F2M.

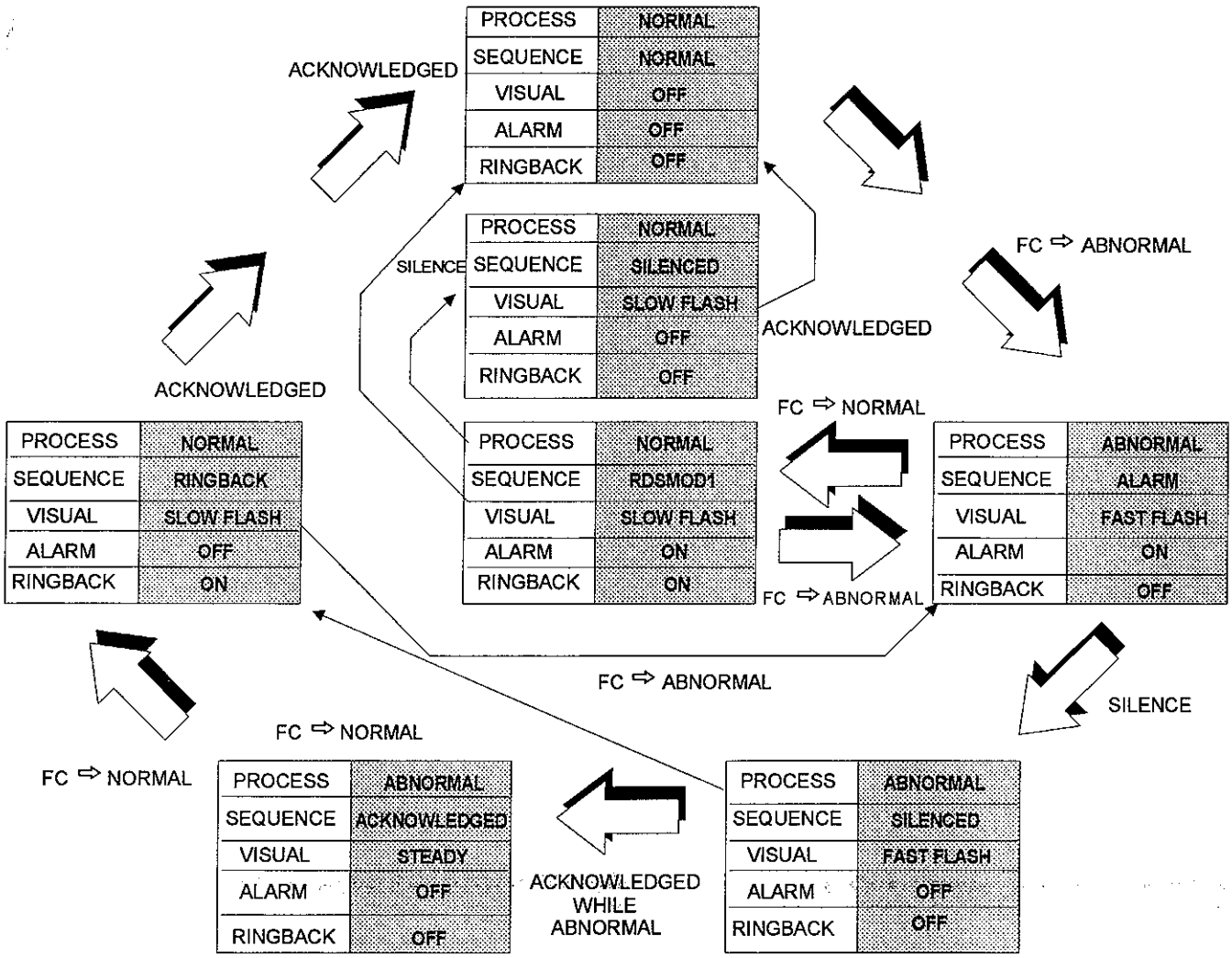
8.0.22 SP5

SP5 is reserved for special sequence. Currently not implemented.

8.0.23 2OF4

2OF4 is a special sequence that is designed with multiple points in mind. There must be at least two points in alarm before the window will go into alarm. Any combination of points that are programmed to the window are to trigger the sequence. When there are less than two points in alarm, then the window will go to normal. The sequence is patterned after RMOD1.

8.0.24 SP1



SECTION 9 - X110 TO ALLEN BRADLEY PLC DATA HIGHWAY INTERFACE

9.1 Introduction

The Ronan Model X110 Annunciator was originally designed to accept and screen ASCII messages pertaining to abnormal and normal process conditions and to initiate appropriate audio-visual responses. A typical alarm message consists of an alarm character followed by the point number that is to go into alarm. The following is a sample of a typical ASCII message that sends point 1048 into alarm on the X110: "A1048<CR>".

In order to interface the X110 directly to Allen Bradley's PLC Data Highway Plus a new method of transferring alarm information was developed. Instead of alarming one point at a time on the X110, as was previously done, the information for all 48 points of the X110 is sent together using the Data Highway/Data Highway Plus Protocol and Command Set.

The mechanism for transferring the alarm information uses a PLC binary file that is sent from the PLC through the Data Highway to an RS232 Converter and finally to the X110. The bits of the PLC's binary file represent points which are being monitored by the PLC and indicate whether the point is in a normal or an abnormal state. The binary file is then transmitted to the X110 periodically for an update of the points monitored by the PLC Program.

The X110 monitors the communication line of the PLC and interprets the binary signals as alarm status information. Every X110 has the capability of visually annunciating up to 48 points (or 48 different bits of the binary file) and up to 8 X110's can be "daisy chained" together to create a system that can annunciate up to 352 points. The X110 can also display any status bit of the binary file on any window of the X110 with the use of the X110 configuration mode.

The PLC software to monitor and transmit an update of the points to the X110 must be written by the customer using the PLC. This assumes that the programmer has complete knowledge of the Allen Bradley PLC and the programmer knows how to program the PLC.

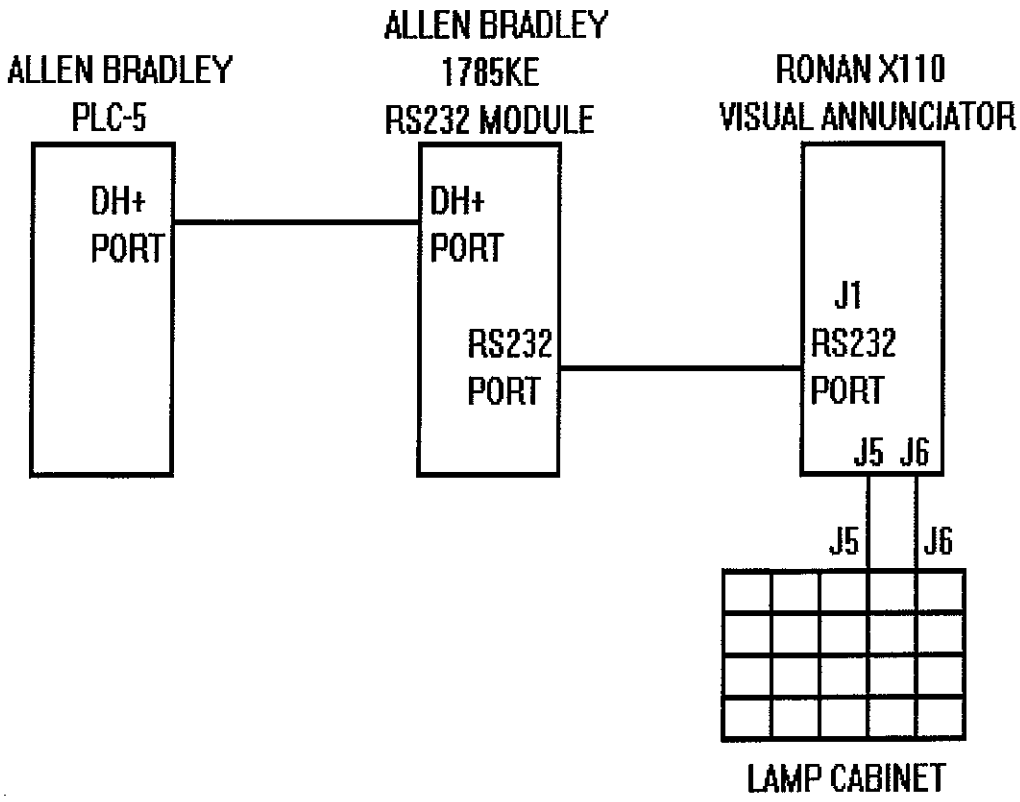


Figure 9-1
Ronan X110/Allen Bradley PLC-5 Configuration

Note: The new version of PLC-5 with the RS232 port does not require the 1785KE module.

9.2 Hardware

The X110 is connected to the Allen Bradley PLC through an Allen Bradley 1785KE Module. The 1785KE Module converts the Data Highway Plug protocol of the PLC to asynchronous, RS232C, ASCII signals that the X110 can understand (see Figure 9-1 for typical configuration).

Since the X110 is connected to a 1785KE module, the X110 is seen as a local node on the Data Highway Network, which allows the X110 to communicate to the PLC on the Data Highway Plus Network. The X110 is programmed to understand the Data Highway/Data Highway Plus Protocol and Command Set and because of this feature, the PLC can easily transmit the alarm status information to the X110. The method used to transmit the alarm status information is discussed in the software section.

Every X110 has the capability of visually annunciating up to 48 points (or 48 different bits of the binary file) and up to 8 X110's can be "daisy chained" together to create a system that can annunciate up to 352 points. The X110 can also display any status bit of the binary file on any window of the X110 with the use of the X110 Configuration Mode. Configuration of the X110 will be discussed in the software section.

9.2.1 Hardware Set-up

The X110 and 1785KE must be set to communicate at 9600 baud, no parity, 1 stop bit, and no hardware handshaking. The 1785KE module must additionally be selected to use BCC checks with no embedded responses. The system should be set up as described in Figure 9-1.

For more details on X110 hardware setup, refer to the X110 Visual Annunciator Operating Instruction Manual.

9.2.2 Cable Drawings

The only cable used to connect the X110 to the 1785KE module is shown in Figure 9-2. The maximum cable length allowed for RS232 communication is 50 feet.

9.3 Software

As discussed in the introduction of this section, the X110 uses a periodic update of alarm status bits from the PLC to monitor different points in the PLC system. The monitoring software must be written by the PLC customer and the software must transfer the alarm information, periodically, from the PLC to the X110 in the form of a binary file using the MSG command of the PLC. The Allen Bradley Software is discussed in Section 9.3.1.

The X110 Configuration Menu is also discussed in Section 9.3.2. This section will detail the steps needed to configure the X110 to an Allen Bradley PLC.

9.3.1 Allen Bradley Software

The Allen Bradley PLC's monitoring software must be written by the customer to update the binary files and to periodically update the X110 of the current alarm status of the PLC system.

9.3.1.1 Binary File Description

The binary file is arranged so that every bit in the file represents the alarm status of an input to the PLC system. The monitoring software of the PLC must update this file and periodically send it to the X110. The X110 will interpret the bits from the binary file in the following way:

BITS 0 - 319 (inclusive)	NORMAL = 1, ABNORMAL = 0
BITS 320 - 351 (inclusive)	NORMAL = 0, ABNORMAL = 1

This means that if bits 0 through 319 are set to a logic level 1, the X110 will interpret those points as in a NORMAL state. If the bits are cleared to a logic level 0, the X110 will interpret those points to be in an ABNORMAL state.

For bits 320 through 351 (inclusive) the opposite is true. If bits 320 through 351 are set to a logical level 1, the X110 will interpret those points to be in an ABNORMAL state. If the bits are cleared to a logic level 0, then the X110 will interpret those points to be in a NORMAL state.

The binary file must be 22 words long.

For more details on Allen Bradley PLC software refer to the Allen Bradley PLC-5 Family Programmable Controller Manual.

9.3.1.2 Transmission of Binary File

The packet of bit information is sent to the X110 using the MSG command of the Data Highway/Data Highway Plus Protocol and Command Set. The PLC must issue this command to update the alarm status of the X110 and it should be done periodically. The fastest allowable rate of transmission of the binary file to the X110 is restricted to one transmission per second.

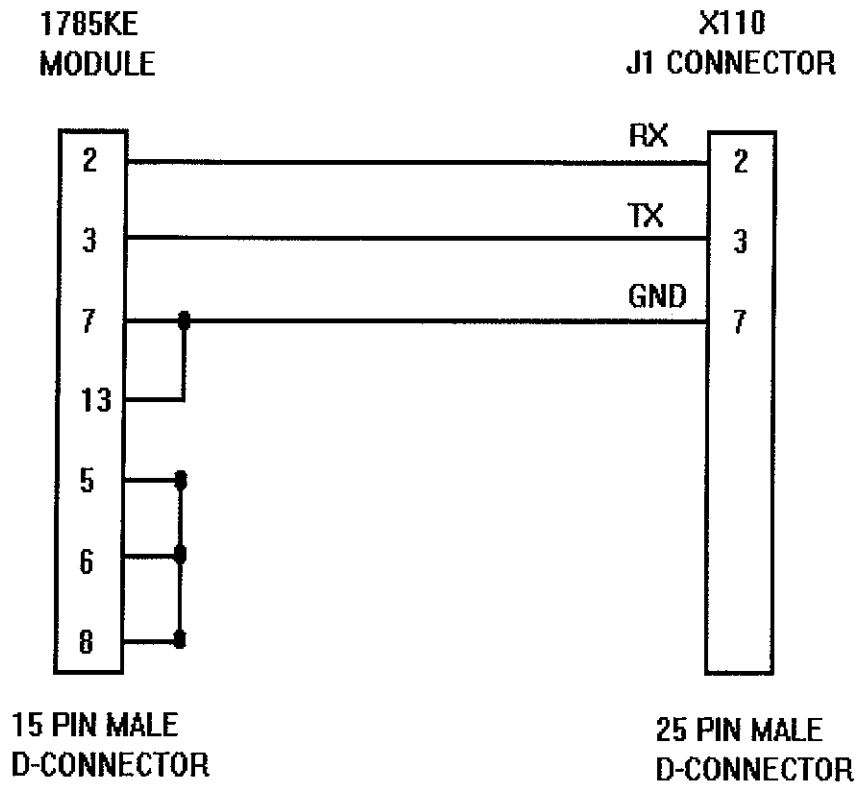


Figure 9-2
Ronan X110 to Allen Bradley 1785KE Cable

When the MSG command is used, several parameters must be used to make the transmission possible. These parameters are listed below:

Read/Write:	Write
PLC-5 Data Table Address:	N11:100 *
Size in Elements:	22
Local/Remote:	Local
Local Node Address:	5 *
Destination Data Table Address:	N/A

* These parameters may be changed.

For more details on Allen Bradley PLC software refer to the Allen Bradley PLC-5 Family Programmable Controllers Manual.

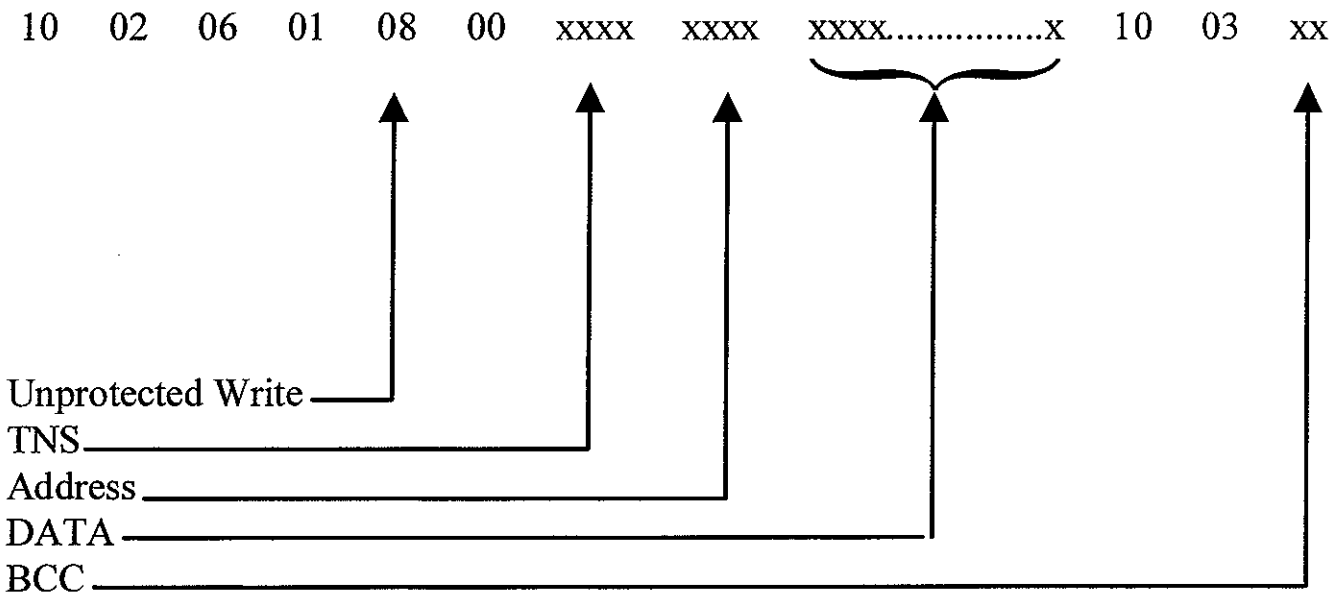
9.4 X110 Configuration

Since the X110 can only display 48 alarms at once, the extra bits sent to the X110 are ignored. The X110 must be configured to select which of the 352 bits are to be used as alarm status indicators. Also the X110 must be told which X110 window will represent which bit. This is done by entering the X110 Configuration Mode. This requires an RS232 terminal or a computer with an RS232 port. For more details on X110 Configuration Mode refer to the X110 Visual Annunciator Operating Instruction Manual.

Once in the configuration mode, the communication parameters must be set as described in Section 9.2.1. This is done by entering the "C" - Communication Menu of Configuration Mode.

Next, the bit to window assignment of the X110 must be set. This is done by entering the "W" - Create Window Assignment Menu. The X110 is now fully configured for operation with the PLC.

Typical string format sent from the PLC-5 to the X110 should look like this:



For more information, refer to Alan Bradley Data Highway Manual.

9.5 SLC 504 – Allen Bradley PLC Setup

9.5.1 Channel "0" System

DF1 – Full Duplex
Baud Rate – 9600
Parity – None
Stop Bit – 1
Protocol Line – No Handshaking
Error Detect – BCC
Embedded Response – Auto Detect
Ack. Timeout – 20mS x 50
NAK Retries – 3
ENQ Retries – 3

9.5.2 Channel "0" User

Driver – ASCII
Baud – 9600
Parity – None
Stop Bit – 1
Data Bit – 8
Protocol Line – No Handshaking
Delete Mode – Ignore
Echo – Blank
Xon/Xoff – Blank

9.5.3 Message Instruction

Type – Pier to Pier
Read/Write – Write
Target Device – 485CIF
Local/Remove – Local
Control Block – N10:0
Control Block Length – 14

9.5.4 Setup Screen – Message Instruction

Channel – 0
Target Node – 9
Source File Address – B3:0
Target CIF Offset – 0
Message Length in Element – 22
Message Time Out in Seconds – 5

9.6 *Enhanced PLC-5 (With an Integral RS-232 Port) Setup*

```
              PLC-5 LADDER LOGISTICS Report header (c) RSI. 1987-1995
                                PLC-5 Ladder Listing
                               Allen-Bradley Company
File #2  Proj:RONAN                    Page:00001                15:50 09/12/96
-------------------------------------------------------------------------------
      |This rung is used to trigger a message to the RONAN once a second
      | T4:0                                                  +--TON------------+
     0+--]/[-----------------------------------------------+Timer On Delay   +-(EN)-
      |   DN                                               |Timer:       T4:0|
      |                                                    |Base (SEC):  0.01+-(DN)-
      |                                                    |Preset:       100|
      |                                                    |Accum:         54|
      |                                                    +-----------------+
      |This rung sends a 22 word message (B3:0 thru B3:21) to the RONAN X110 system.
      |The message is in PLC-2 Unprotected Write format.  Bit B3/1 corresponds to window
      |1, B3/2 to window 2 and so on.  1=Normal, 0=Alarm
      | T4:0                                             +--MSG--------------+
      1+--] [-------------------------------------------+Send/Receive Message+-(EN)-
      |    DN                                            |Control:      MG10:0+-(DN)-
      |                                                  |--------------------+-(ER)-
      |                                                  +--------------------+
```

```
            Message Instruction Status Screen - Control Block: MG10:0

Communication Command...: PLC-2 Unprotected Write
PLC-5 Data Table Address: B3:0                  Ignore if Timed-Out:  0 TO
Size in Elements........: 22                         To be Retried:  0 NR
Local/Remote............: Local                 Awaiting Execution:  0 EW
   Remote Station.......: N/A                           Continuous:  0 CO
   Link ID..............: N/A                                Error:  0 ER
   Remote Link Type.....: N/A                       Message Done:  0 DN
Local Node Address......: 00                  Message Transmitting:  0 ST
Destination D.T. Address: 10                       Message Enabled:  0 EN
Port Number.............: 0

Error Code:  0000

Block Size:  56 Words, 1 Element(s)

Channel Configuration
```

Channel 0:	System (Point to Point)
Channel 1A:	DH+
Channel 1B:	Scanner Mode
Channel 2:	ETHERNET
Channel 3A:	Unused

```
Channel 0 Configuration
                        System (Point to Point)

Diagnostic File.... :          0
Remote Mode Change. :   Disabled     System Mode Char:          S
Mode Attention Char :      \0x1b     User Mode Chart.:          U

Baud Rate:                  9600     Parity:                 None
Stop Bits:                     1
Control Line:  NO HANDSHAKING

                                     Error Detect:            BCC
Duplicate Detect:             ON     NAK Receive:               3
ACK Timeout (20ms):           50     DF1 ENQS:                  3
Msg Appl Timeout (30 sec):     1
```

X110 MODBUS PROTOCOL
ModBus.R06
BY: Kevin Safaiyeh, 2-20-99

The X110 with Modbus protocol firmware can be setup to communicate with PLCs using either of two serial transmission modes: ASCII or RTU.

ASCII serial transmission mode

When X110s are setup to communicate to PLCs using ASCII (American Standard Code for Information Interchange) mode, each 8-bit byte in a message is send as two ASCII characters. The main advantage of this mode is that it allows time intervals of up to one second to occur between characters without causing an error. Refer to page 7 for switch settings.

The format for each byte in ASCII mode is:

Coding system:

Hexadecimal, ASCII characters 0-9, A-F. One hexadecimal character contained in each ASCII character of the message.

Bits per Byte:

1 start bit, 7 data bits, 1 bit for even parity, 1stop bit.

Error Check Field:

Longitudinal Redundancy Check (LRC). Refer to page 6 for LRC calculation.

ASCII Framing:

In ASCII mode, message start with a 'colon' (:) character (ASCII 3A hex), and end with a Carriage Return - Line Feed (CRLF) pair (ASCII 0D and 0A hex).

A typical ASCII message frame is shown below.

START	1 CHAR (:)
ADDRESS	2 CHARS
FUNCTION	2 CHARS
DATA	n CHARS
LCR CHECK	2 CHARS
END	2 CHARS (CR,LF)

RTU serial transmission mode

When X110s are setup to communicate to PLCs using RTU (Remote Terminal Unit) mode, each 8-bit byte in a message contains two 4-bit hexadecimal characters. The main advantage of this mode is that its greater character density allows better data throughput than ASCII for the same baud rate. Each message must be transmitted in a continuous stream. Refer to page 7 for switch settings.

The format for each byte in RTU mode is:

Coding System:

8-bit binary, hexadecimal 0-9, A-F.
Two hexadecimal characters contained in each 8-bit field of the message.

Bits per Byte:

1 start bit, 8 data bits, no bits for no parity, 1 stop bits.

Error Check Field:

Cyclical Redundancy Check (CRC). Refer to page 6 for CRC calculation.

RTU Framing:

In RTU mode, messages start with a silent interval of at least 3.5 character times shown as T1-T2-T3-T4 in the message frame below. Following the last transmitted character, a similar interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval.

A typical RTU message frame is shown below.

START	T1-T2-T3-T4
ADDRESS	8 bits
FUNCTION	8 bits
DATA	8 bits x n
CRC CHECK	16 bits
END	T1-T2-T3-T4

The X110 with Modbus protocol firmware can be configured to communicate with PLCs as either MASTER or SLAVE device.

X110 configured as a MASTER device for ModBus protocol

When X110 is configured as a MASTER device, it will send a Query message to PLC each second as shown in figure 1. The X110 as a MASTER device uses FUNCTION code 2 or 1 (switch selectable) which are to read the ON/OFF status of discrete PLC's inputs or outputs. The Query and Response message frames for FUNCTION 2 are shown in figure 1 and 2. **(Refer to page 7 for switch settings.)**

NOTES:

1- The default starting address is 0000 and can be changed by going to configuration menu of the X110 and using option (U) . The range is from 0 to 64000.

2- The No. of Points is 512 OR 800 (switch selectable by SW1-3).

3- The Slave Address can be change by going to configuration menu of the X110 and using option (U). The range is from 1 to 32.

4- The function values are FUNCTION 2 (Read Input Status) or FUNCTION 1 (Read Output Status) and are switch selectable by SW1-4.

5- The Query and Response messages for FUNCTION 1 and 2 are the same, except the FUNCTION value.

6- The Transmission period is once per second.

7- Any COIL/INPUT (1-800) of PLC can be assigned to a windows in X110 by going to configuration mode and using option (W).
(ONLY ONE POINT CAN BE ASSIGNED TO ONE WINDOW IN ModBus PROTOCOL)

8- Refer to X110 installation and operating manual for more information about configuration mode.

X110 configured as a SLAVE device for ModBus protocol

When X110 is configured as an Slave device, it will respond to two Function code [05 and 16 (10 Hex)] described below:

Function Code 05 (Force Single Coil)

Description

Forces a single coil to either ON or OFF.

Query

The query message from the master device specifies the coil references to be forced. Coils are addressed starting at zero: Coil 1 is addressed as 0.

The requested ON/OFF state is specified by a constant in the query data field. A value of FF 00 hex request the coil to be ON. A value of 00 00 requests it to be OFF. All other values are illegal and will not affect the coil.

Figure 3 shows an example of query message from the MASTER PLC which is a request to force Coil 05 ON in slave device (X110) 01. Refer to page 7 for switch settings.

Response

The normal response is an echo of the query, returned after the coil state has been forced.

Figure 4 shows an example of slave device (X110) response message to master device (PLC) query message.

NOTES:

1- Any COIL/INPUT (1-800) of PLC can be assigned to a window in X110 by going to configuration mode and using option (W).
(ONLY ONE POINT CAN BE ASSIGNED TO ONE WINDOW IN ModBus PROTOCOL)

2- Refer to X110 installation and operating manual for more information about configuration mode.

3- The slave Address can be set by going to configration menu of the X110 and using option (U). The range is from 1 to 32. If the slave Address of the PLC is not the same as slave Address of the X110, the X110 will not respond to the PLC's commands.

Function Code 16 (10 Hex) [Preset Multiple Regs]

Description

Presets values into a sequence of holding registers.

Query

The Query message specifies the register references to be preset. Registers are addressed starting at zero: register 1 is addressed as 0. These registers then will be used by X110 to force the referenced bit (coil) ON of OFF.

The requested preset values which are specified in the query data field and should be packed as described below:

1- Data should be packed as two bytes per register.
2- The first DATA byte addresses coils 1-8 with the most significant bit addressing the lowest coil (1) and so on.
3- Coils are addressed starting at 0000 hex, so coil 1 should be addressed as 0000.
4- The max. number of Byte Count should be 32Hex which is 50X16 = 800.

Figure 5 shows an example of query message for Function code 16 (10 Hex) which has to be transmitted from the Master device.

Response

The normal response returns the slave address, function code, starting address and quantity of registers preset.

Figure 6 shows the slave device (X110) response message .

NOTES:

1- Any COIL/INPUT (1-800) of PLC can be assigned to a window in X110 by going to configuration mode and using option (W).
(ONLY ONE POINT CAN BE ASSIGNED TO ONE WINDOW IN ModBus PROTOCOL)

2- Refer to X110 installation and operating manual for more information about configuration mode.

LRC (Longitudinal Redundancy Check) calculation

The LRC is calculated by adding together successive 8-bit bytes of the message, discarding any carries, and then two's complementing the result. It is performed on the ASCII message field contents excluding the 'colon' character that begins the message, and excluding the CRLF pair at the end of the message.

CRC (Cyclical Redundancy Check) calculation

The CRC is started by first preloading a 16-bit register to all 1's. Then a process begins of applying successive 8-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit if one is used, do not apply to the CRC.

During generation of the CRC, each 8-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, The register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place. The preset fixed value is A001 hex.

This process is repeated until eight shifts have been performed. After the last (eight) shift, the next 8-bit byte is exclusive ORed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all bytes of the message have been applied, is the CRC value.

X110 switch settings for MODBUS protocol

The X110 has one row of 8 Dip switches, called SW1, which mast be set before any X110 can communicate with the PLC. The following shows the function of SW1.

Refer to figure 7 for quick lookup table for switch settings.

SW1-1 determines the ASCII or RTU mode in X110.

RTU	SW1 = ON
ASCII	SW1 = OFF

NOTES:

1- In ASCII, the communication parameters in X110 for both RUN and CONFIGURATION mode are set to:
9600 baud, 1 start bit, 7 bit data, 1bit for even parity, 1 stop bit.

2- In RTU, the communication parameters in X110 for both RUN and CONFIGURATION mode are set to:
9600 baud, 1 start bit, 8 bit data, no bit for no parity, 1 stop bit

SW1-2 determines the MASTER or SLAVE mode for MODBUS protocol in X110.

MASTER	SW1-2 = ON
SLAVE	SW1-2 = OFF

Refer to page 3 and 4 of this manual for more information about the master and slave mode.

NOTES:

1- If there are more than one X110 in the string and the MASTER mode is required, set only one of the X110 as a master (the last one in the string, farthest from the host device).

2- The SW1-2 is not the same as SW1-7 which is to configure the X110 as a communication master. Refer to page 19 of the X110 instruction manual for more information on SW1-7.

SW1-3 determines the number of points to be requested by the X110 in master mode. from the PLC.

SW1-3 = ON 800 POINTS
SW1-3 = OFF 512 POINTS

SW1-4 determines which MODBUS Function code to be used by X110 in MASTER mode.

SW1-4 = OFF FUNCTION CODE 1 (read output status)
SW1-4 = ON FUNCTION CODE 2 (read input status)

SW1-5 to SW1-8 are the same as standard X110.

Refer to X110 instruction manual for information.

QUERY

Field Name	Example (Hex)	ASCII Characters	RTU 8-bit Field
Header		: (colon)	None
Slave Address	0 6	0 6	0000 0110
Function	0 2	0 2	0000 0010
Starting Address Hi	0 0	0 0	0000 0000
Starting Address Lo	0 0	0 0	0000 0000
No. of Point Hi	0 2	0 0	0000 0010
No. of Point Lo	0 0	0 0	0000 0000
Error Check		LRC (2 chars)	CRC (16 bits)
Trailer		CR LF	None

Figure 1. Read Input Status - Query

RESPONSE

Field Name	Example (Hex)	ASCII Characters	RTU 8-bit Field
Header		: (colon)	None
Slave Address	0 6	0 6	0000 0110
Function	0 2	0 2	0000 0010
Byte Count	6 4	6 4	0110 0100
Data (inputs 8-1)	AC	A C	1010 1100
Data (inputs xxx-xxx)	X X	X X	xxxx xxxx
Data (inputs xxx-xxx)	X X	X X	xxxx xxxx
Data (inputa 800-793)	0 2	0 2	0000 0010
Error Check		LRC (2 chars)	CRC (16 bits)
Trailer		CR LF	None

Figure 2. Read Input Status - Response

QUERY

Field Name	Example (Hex)	ASCII Characters	RTU 8-bit Field
Header		: (colon)	None
Slave Address	0 1	0 1	0000 0001
Function	0 5	0 5	0000 0101
Coil Address Hi	0 0	0 0	0000 0000
Coil Address Lo	0 0	0 4	0000 0100
Force Data Hi	F F	F F	1111 1111
Force Data Lo	0 0	0 0	0000 0000
Error Check		LRC (2 chars)	CRC (16 bits)
Trailer		CR LF	None

Figure 3. Force Single Coil - Query

RESPONSE

Field Name	Example (Hex)	ASCII Characters	RTU 8-bit Field
Header		: (colon)	None
Slave Address	0 1	0 1	0000 0001
Function	0 5	0 5	0000 0101
Coil Address Hi	0 0	0 0	0000 0000
Coil Address Lo	0 0	0 4	0000 0100
Force Data Hi	F F	F F	1111 1111
Force Data Lo	0 0	0 0	0000 0000
Error Check		LRC (2 chars)	CRC (16 bits)
Trailer		CR LF	None

Figure 4. Force Single Coil - Response

QUERY

Field Name	Example (Hex)	ASCII Characters	RTU 8-bit Field
Header		: (colon)	None
Slave Address	0 2	0 2	0000 0010
Function	1 0	1 0	0001 0000
Starting Address Hi	0 0	0 0	0000 0000
Starting Address Lo	0 0	0 1	0000 0001
No. of registers Hi	0 0	0 0	0000 0000
No. of registers Lo	0 2	0 2	0000 0010
Byte Count	0 4	0 4	0000 0100
Data Hi	0 0	0 0	0000 0000
Data LO	0 8	0 8	0000 1000
Data Hi	0 3	0 3	0000 0011
Data Lo	A 7	A 7	1010 0111
Error Check		LRC (2 chars)	CRC (16 bits)
Trailer		CR LF	None

Figure 5. Preset Multiple Regs - Query

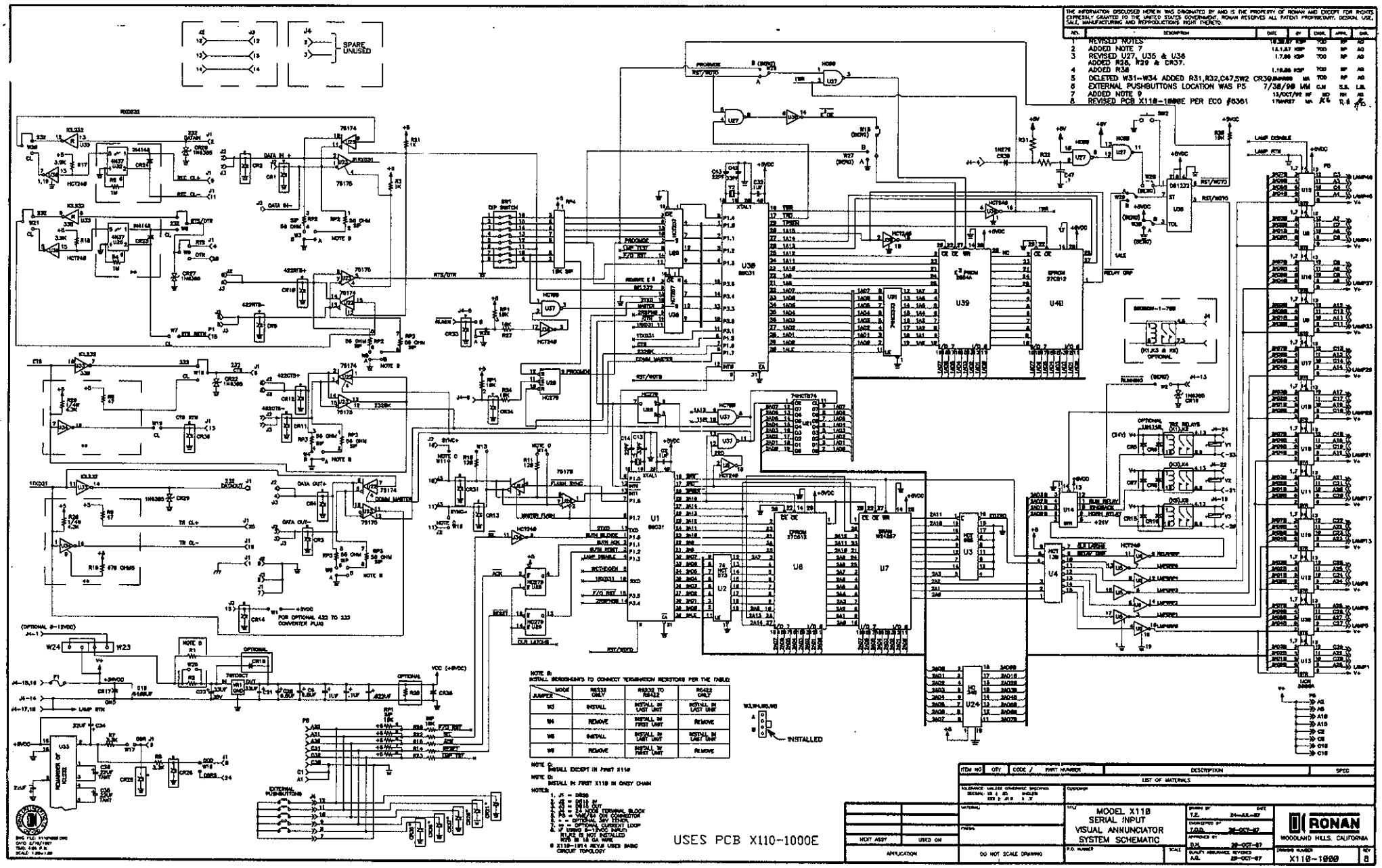
RESPONSE

Field Name	Example (Hex)	ASCII Characters	RTU 8-bit Field
Header		: (colon)	None
Slave Address	0 2	0 2	0000 0010
Function	1 0	1 0	0001 0000
Starting Address Hi	0 0	0 0	0000 0000
Starting Address Lo	0 1	0 1	0000 0001
No. of Register Hi	0 0	0 0	0000 0000
No. of Register Lo	0 2	0 2	0000 0010
Error Check		LRC (2 chars)	CRC (16 bits)
Trailer		CR LF	None

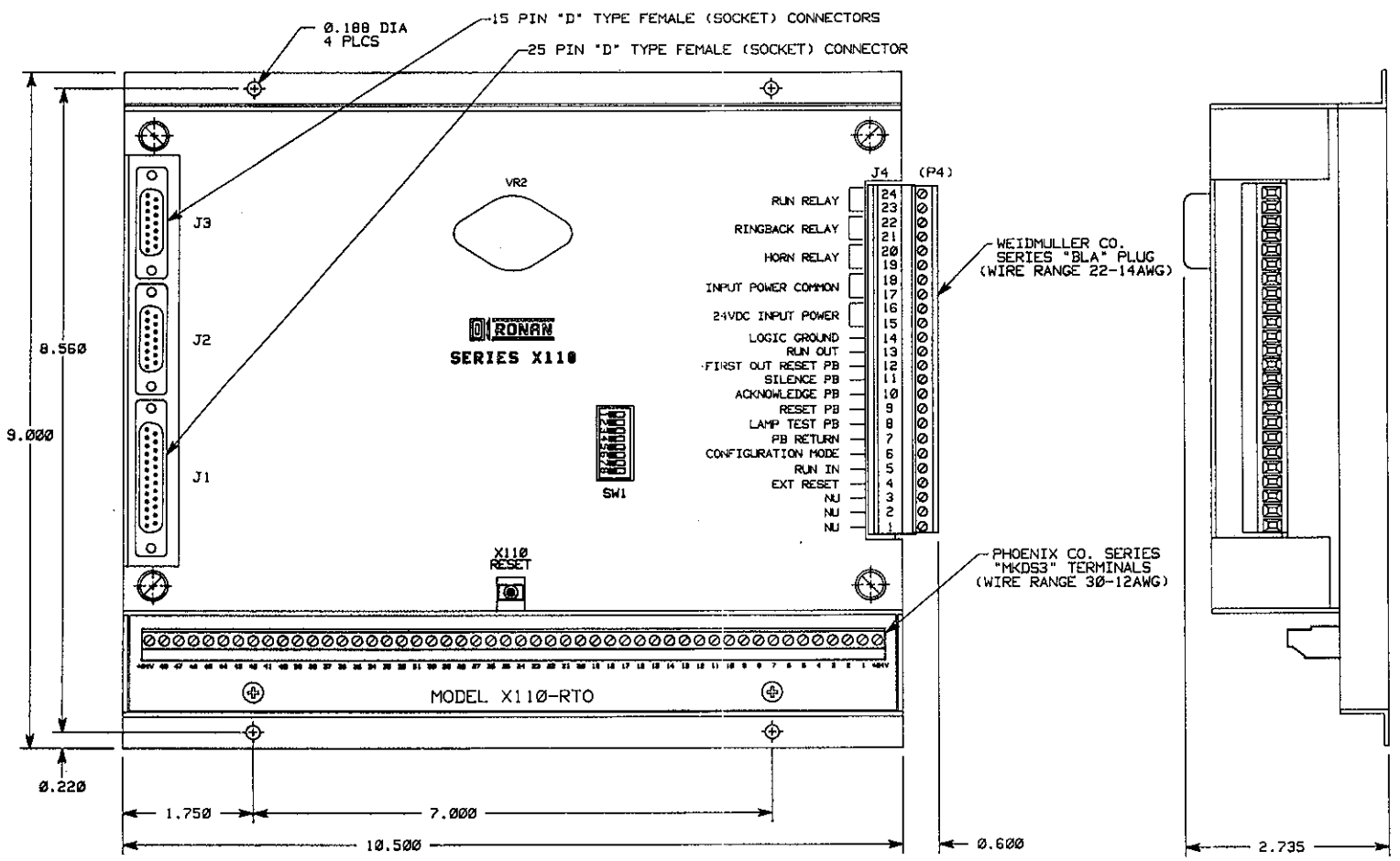
Figure 6 - Preset Multiple Regs - Response

SW1-1=ON	RTU serial transmission mode
SW1-1=OFF	ASCII serial transmission mode
SW1-2=ON	MASTER device for ModBus protocol
SW1-2= OFF	SLAVE device for ModBus protocol
SW1-3=ON	800 POINTS (for master mode only)
SW1-3=OFF	512 POINTS (for master mode only)
SW1-4=ON	FUNCTION 2 (for master mode only)
SW1-4=OFF	FUNCTION 1 (for master mode only)
SW1-5=ON	EEPROM is write protected
SW1-5=OFF	EEPROM can be written
SW1-6=ON	RS422/485 enebled
SW1-6=OFF	RS232 or Current Loop enabled
SW1-7=ON	This X110 is the Master
SW1-7=OFF	This X110 in not the Master
SW1-8=ON	This X110 is in the Configuration mode
SW1-8=OFF	This X110 is in the Run mode

Figure 7. The X110 switch settings


SPARE - UNUSED
USES PCB X110-1000E
MODEL X110
SERIAL INPUT
VISUAL ANNUNCIATOR
SYSTEM SCHEMATIC
RONAN
WOODLAND HILLS, CALIFORNIA
X110-1000
LIST OF MATERIALS
DO NOT SCALE DRAWING

REV	DESCRIPTION	DATE	BY	ENGR	APPR	QAR



NOTE: THIS DRAWING SUPPLEMENTS AND IS TO BE USED IN CONJUNCTION WITH THE X110 "INSTRUCTIONS AND OPERATING MANUAL". SEE MANUAL FOR ADDITIONAL INSTALLATION INFORMATION.

ITEM NO	QTY	CODE / PART NUMBER	DESCRIPTION	SPEC

LIST OF MATERIALS

TOLERANCE UNLESS OTHERWISE SPECIFIED: DECIMALS XX ± .03, XXX ± .010; ANGLES ± 4°

CUSTOMER

MATERIAL

FINISH

NEXT ASSY: X110D16

USED ON: X110D4

APPLICATION

DO NOT SCALE DRAWING

TITLE: OUTLINE, X110-RTO CONTROLLER MODULE

P.O. NUMBER

SCALE

DRAWN BY: M MARTIN 02-JUL-88

ENGINEERED BY: CM 7/12/90

APPROVED BY: RP 7-19-90

QUALITY ASSURANCE REVIEWED: A Blake 7/19/90

RONAN
WOODLAND HILLS, CALIFORNIA

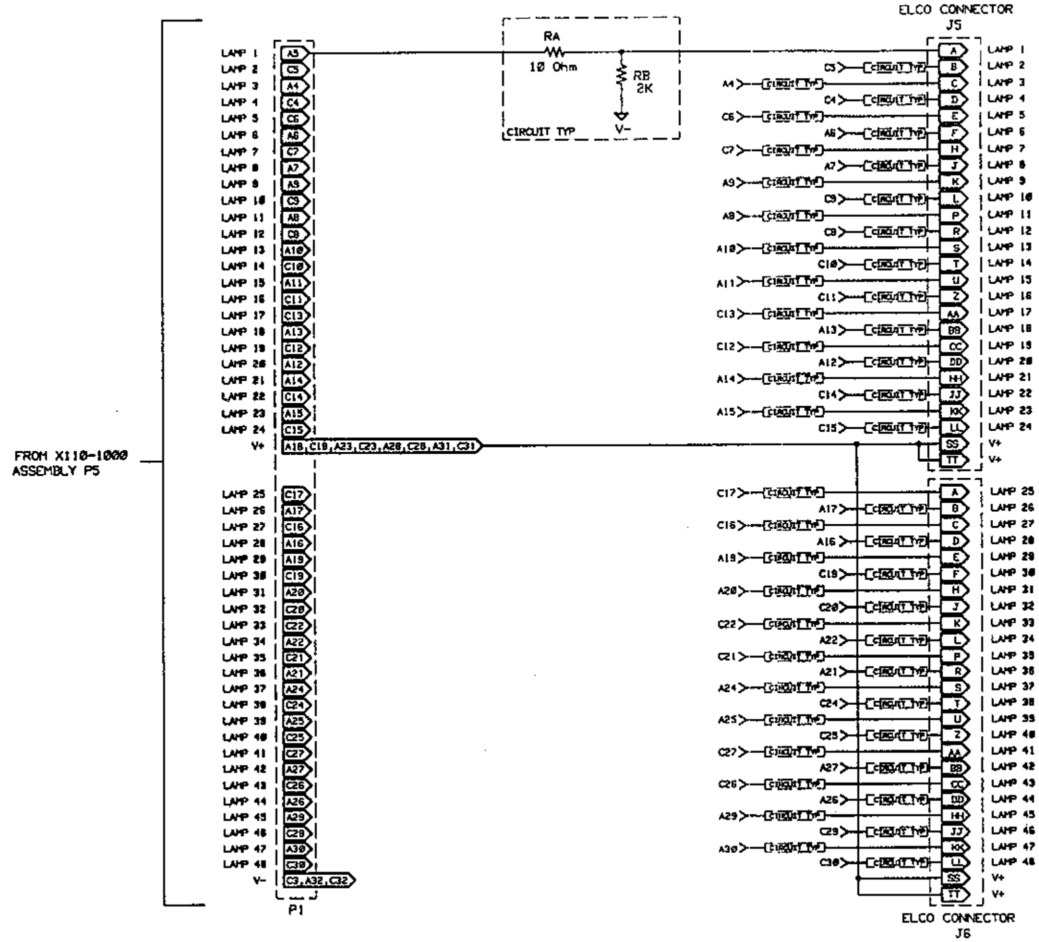
DRAWING NUMBER: X110C71

REV: 0

DISK01:X110RW FL:1

IG.6X110C871 R0 88-000-88

RONAN RECORDER NO 003-C



X110 LAMP No.	CONNECTOR P1 POSITION	"RA"	"RB"	J5	J6
1	A5	R49	R1	A	-
2	C5	R73	R25	B	-
3	A4	R50	R2	C	-
4	C4	R74	R26	D	-
5	C6	R51	R3	E	-
6	A6	R75	R27	F	-
7	C7	R52	R4	H	-
8	A7	R76	R28	J	-
9	A9	R53	R5	K	-
10	C9	R77	R29	L	-
11	A8	R54	R6	P	-
12	C8	R78	R30	R	-
13	A10	R55	R7	S	-
14	C10	R79	R31	T	-
15	A11	R56	R8	U	-
16	C11	R80	R32	Z	-
17	C13	R57	R9	AA	-
18	A13	R81	R33	BB	-
19	C12	R58	R10	CC	-
20	A12	R82	R34	DD	-
21	A14	R59	R11	HH	-
22	C14	R83	R35	JJ	-
23	A15	R60	R12	KK	-
24	C15	R84	R36	LL	-
25	C17	R61	R13	-	A
26	A17	R85	R37	-	B
27	C16	R62	R14	-	C
28	A16	R86	R38	-	D
29	A19	R63	R15	-	E
30	C19	R87	R39	-	F
31	A20	R64	R16	-	H
32	C20	R88	R40	-	J
33	C22	R65	R17	-	K
34	A22	R89	R41	-	L
35	C21	R66	R18	-	P
36	A21	R90	R42	-	R
37	A24	R67	R19	-	S
38	C24	R91	R43	-	T
39	A25	R68	R20	-	U
40	C25	R92	R44	-	Z
41	C27	R69	R21	-	AA
42	A27	R93	R45	-	BB
43	C26	R70	R22	-	CC
44	A26	R94	R46	-	DD
45	A29	R71	R23	-	HH
46	C29	R95	R47	-	JJ
47	A30	R72	R24	-	KK
48	C30	R96	R48	-	LL

1. THIS SCHEMATIC REPRESENTS P.C.B. X110-1005A.

NOTE: UNLESS OTHERWISE SPECIFIED,

LIST OF MATERIALS

TITLE: SCHEMATIC, X110-RCO "KEEP ALIVE" BOARD

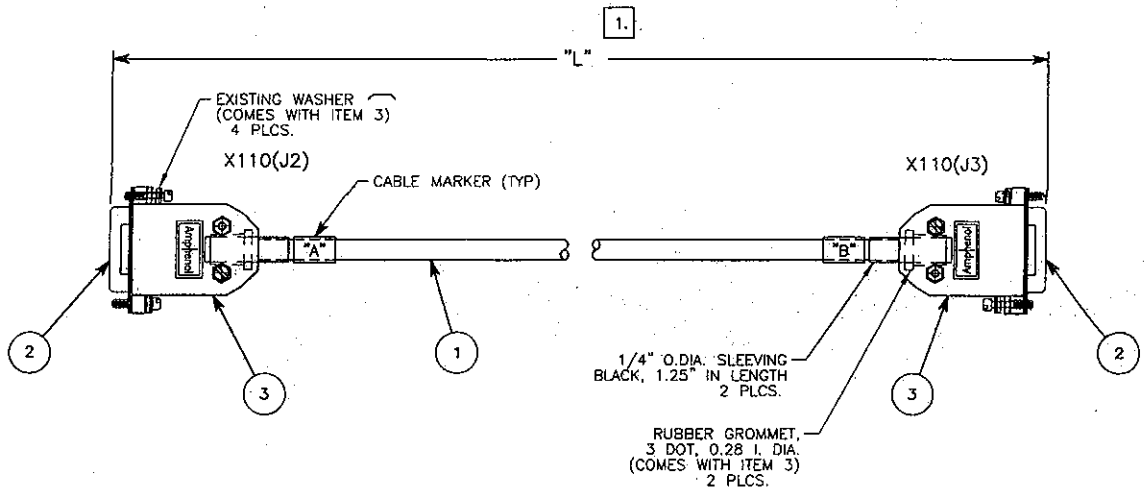
RONAN
WOODLAND HILLS, CALIFORNIA

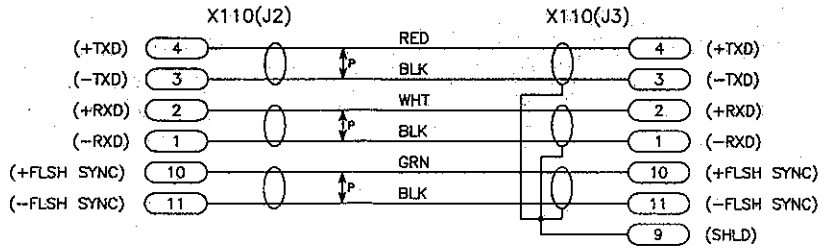
DRAWING NUMBER: X110-D62 REV: 0

DO NOT SCALE DRAWING

DISK#: X110#1 FOLDER#: #1
IG.#X110D62 R0 00-000-00

REV.	DESCRIPTION	DATE	BY	ENGR.	APPR.	QAR.
1	REVISED PER ECO#13344	2-22-05	KP	TH	RP	MLD
2	REVISED PER ECO#13603	090205	MZ	TH	RP	AG
3	REVISED PER ECN #8371	21NOV09	SSW	TH	[illegible]	MLD





1. LENGTH AS SPECIFIED + 6.0, -0.0 INCH

NOTE, UNLESS OTHERWISE SPECIFIED:

ITEM NO	QTY	CODE / PART NUMBER	DESCRIPTION	SPEC
3	2	17E-1725-2	BACK SHELL, PLATED, 15 PIN, 'D' CONN.	AMP
2	2	DA15P	CONNECTOR, 15 PIN (MALE)	ITT CANNON
1	AR	9730	CABLE	BELDEN

LIST OF MATERIALS

TOLERANCE: UNLESS OTHERWISE SPECIFIED
DECIMAL: XX ± .03 ANGLES:
XXX ± .010 ± .5°

CUSTOMER

MATERIAL

FINISH

NEXT ASSY | USED ON
APPLICATION | X110-ALL

DO NOT SCALE DRAWING

TITLE: SERIES X110-100 CABLE ASSEMBLY (RS-422/485) X110 TO X110 TO CONTROLLER MODULE

P.O. NUMBER

SCALE

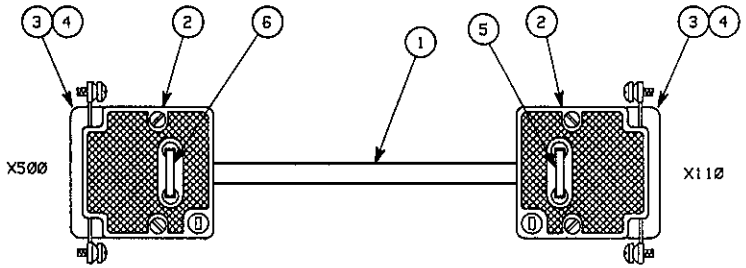
DRAWN BY: T. TSCHAPPAT DATE: 5/9/90
ENGINEERED BY: CM 5-10-90
APPROVED BY: SS 5-10-90
QUALITY ASSURANCE REVIEWED: AG 5-10-90

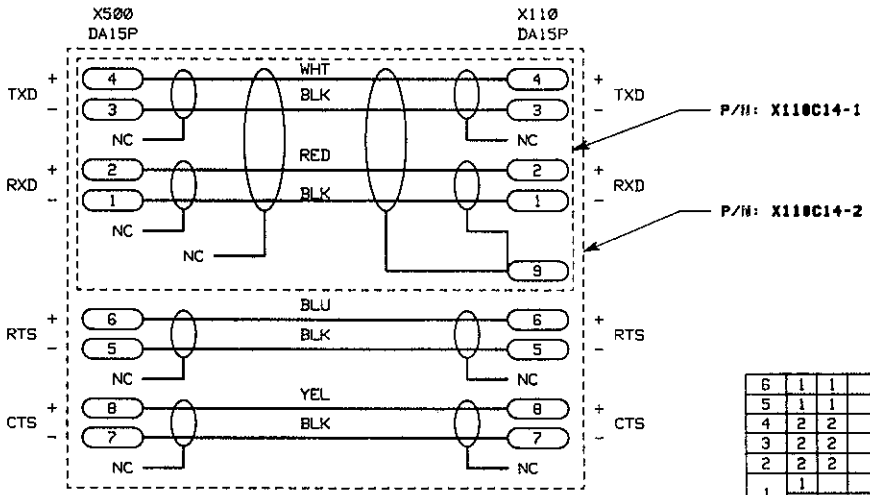
RONAN
WOODLAND HILLS, CALIFORNIA

DRAWING NUMBER: X110C67 REV: 3

DWG FILE: X110C067.DWG
DATE: 9/7/2005
TIME: 8:37 AM
SCALE: 1.00=1.00
H:\ENGDWG\XSTD\X110\

REV.	DESCRIPTION	DATE	BY	ENGR.	APPR.	QAR.
1	ADDED ITEMS 5 & 6 REPLACED X110 WITH X500 AS REQ'D ADDED COLOR CODES REMOVED SHIELD CONNECTION ON X500 SIDE ADDED ADDITIONAL SHIELD TO PAIR ± RXD.	03-06-88	J.M.	TOD		





ITEM	QTY -2	QTY -1	PART NO	DESCRIPTION	SPEC
6	1	1	LABEL	X500	
5	1	1	LABEL	X110 P2	
4	2	2	DA15P	15 PIN CONNECTOR (MALE)	CANNON
3	2	2	DA20419	CONNECTOR ACCESSORIES	CANNON
2	2	2	DA110963-2	COVER	CANNON
1	1		9731	CABLE (6 PAIRS)	BELDEN
		1	9730	CABLE (3 PAIRS)	BELDEN

ITEM NO. | QTY | CODE / PART NUMBER | DESCRIPTION | SPEC

LIST OF MATERIALS

TOLERANCE UNLESS OTHERWISE SPECIFIED: DECIMALS XX ± .03, XXX ± .010; ANGLES ± ½°

CUSTOMER

MATERIAL

FINISH

NEXT ASSY | USED ON

APPLICATION

DO NOT SCALE DRAWING

TITLE: X110 TO X500 RS422/485 CABLE

P.O. NUMBER | SCALE

DRAWN BY [signature] 03-06-88

ENGINEERED BY R.P. 03-06-88

APPROVED BY S.S. 03-06-88

QUALITY ASSURANCE REVIEWED A.G. 03-06-88

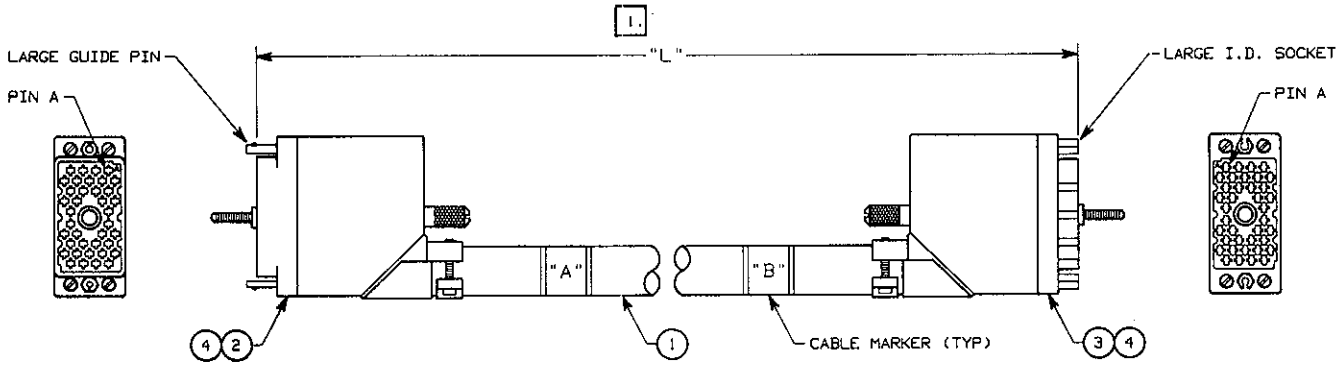
RONAN
WOODLAND HILLS, CALIFORNIA

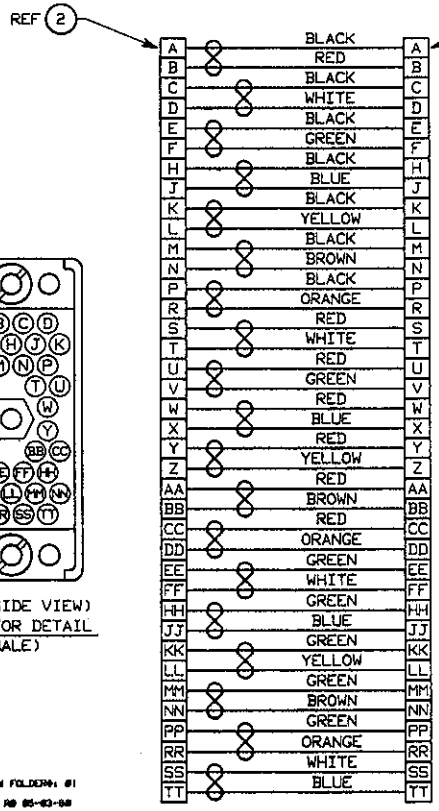
DRAWING NUMBER X110C14 | REV 1

VOL: XSTD 110 & X110MB FOLDER#:11
IG.#X110C014 R1 09_06-88

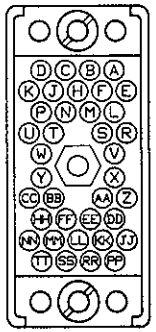
RONAN RECORDER NO 003-C

REV	DESCRIPTION	DATE	BY	ENGR	APPR	QAR

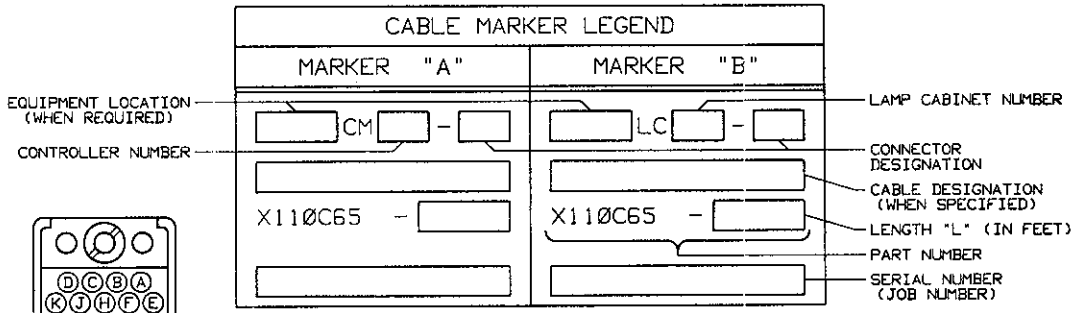




(WIRE SIDE VIEW)
CONNECTOR DETAIL
(MALE)



(WIRE SIDE VIEW)
CONNECTOR DETAIL
(FEMALE)



2. CIRCUIT ASSIGNMENTS ARE IDENTIFIED IN X110 INSTALLATION AND OPERATING MANUAL.

1. LENGTH AS SPECIFIED +6.0, -0.0 INCH.

NOTE, UNLESS OTHERWISE SPECIFIED:

ITEM NO	QTY	CODE / PART NUMBER	DESCRIPTION	SPEC
4	72	60-0017-03-23	CONTACT	ELCO
3	1	8016-038-000-823	CONNECTOR	ELCO
2	1	8016-038-000-819	CONNECTOR	ELCO
1	AR	9748	CABLE	BELDEN

LIST OF MATERIALS

TOLERANCE UNLESS OTHERWISE SPECIFIED: DECIMALS XX ± .03, XXX ± .010, ANGLES ± 1°

CUSTOMER

MATERIAL

FINISH

NEXT ASSY | USED ON: X110RC0

APPLICATION | DO NOT SCALE DRAWING

TITLE: SERIES X110-238 CABLE ASSEMBLY CONTROLLER MODULE (CM) TO LAMP CABINET (LC)

P.O. NUMBER | SCALE

DRAWN BY: T. TSCHAPPAT 5/3/90

ENGINEERED BY: CM 5/8/90

APPROVED BY: 5/8/90

QUALITY ASSURANCE REVIEWED: 5/8/90

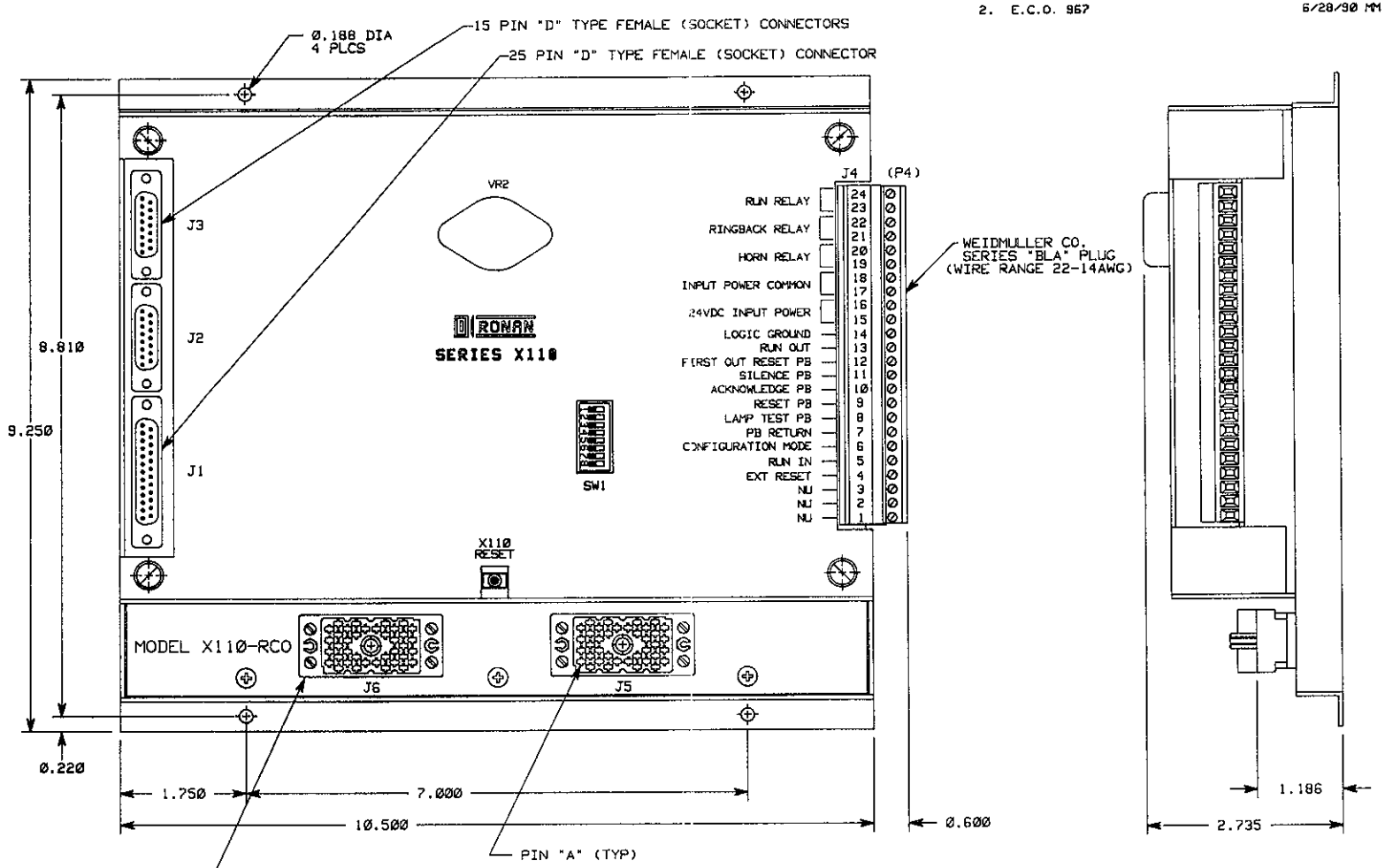
RONAN
WOODLAND HILLS, CALIFORNIA

DRAWING NUMBER: X110C65 | REV: 0

RONAN RECORDER NO 803-C

DISK#: X110#4 FOLDER#: 01
IG.4X110C65 R0 05-03-90

REV	DESCRIPTION	DATE	BY	ENGR	APPR	QAR
1.	ADDED ELEVATION INFO. DELETED J5 AND J6 LAMP SIGNALS (SEE I/O MANUAL)	2/1/90	MM	CM	RP	AG
2.	E.C.O. 957	6/28/90	MM	CM	RP	AG



NOTE: THIS DRAWING SUPPLEMENTS AND IS TO BE USED IN CONJUNCTION WITH THE X110 "INSTRUCTIONS AND OPERATING MANUAL". SEE MANUAL FOR ADDITIONAL INSTALLATION INFORMATION.

ITEM NO	QTY	CODE / PART NUMBER	DESCRIPTION	SPEC
		LIST OF MATERIALS		

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMALS XX ± .03 ANGLES
XXX ± .010 ± 1°

CUSTOMER

MATERIAL

FINISH

NEXT ASSY | USED ON

X110D16

X110D11

APPLICATION

DO NOT SCALE DRAWING

TITLE: OUTLINE, X110-RCO CONTROLLER MODULE

P.O. NUMBER

SCALE

DRAWN BY	KWANG	03-JAN-89
ENGINEERED BY	C. H.	01-FEB-89
APPROVED BY	R. P.	08-FEB-89
QUALITY ASSURANCE REVIEWED	A. G.	08-FEB-89

RONAN
WOODLAND HILLS, CALIFORNIA

DRAWING NUMBER: X110C33 REV: 2

DISK#:X110#4 FL:1
IG.6X110C033 R8 28-JUN-88

RONAN REORDER NO 003-C